the OIL AND GAS JOURNAL

JULY 9, 1956

Direct Efficiency Tests On Pipeline Pumps During Operation

P. 76 . . . using new torque pickup

How hard will steel strike hit oil?

Here's a staff rundown on some of the vulnerable spots p. 58

New down-hole milling tool

It's a rare fish that doesn't yield to this fast-cutting instrument p. 80

Complete table of contents and article digests on pages 2 - 3

THE NEW CAMERON "CA" CASING HANGER LETS YOU

Hold Everything!

Hold Heaviest Casing Loads Without Crushing Pipe

Hold Lightest Casing Loads, Yet Seal High Pressures

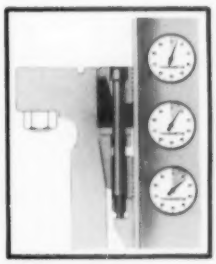
Here is a truly remarkable improvement in casing hanger design . . . the result of years of experience in casing suspensions and seals coupled with a determination to produce a hanger that combines the best features of present designs, yet eliminating many objectionable features and limitations.

The "CA" Hanger is interchangeable in all regular Cameron casing heads. It is fully automatic in operation and can handle pipe loads to joint strength without damage to the pipe. On the other hand, its self-energizing resilient seal is so efficient that it effectively and automatically seals off highest pressures even though the casing load may be extremely low.

Hold everything . . . until you have inspected this new hanger. Better still, order one now for your next casing string.

The "CA" Hanger — wrap-around design, automatic setting and sealing; interchangeable in all regular Cameron casing heads.

Even under lightest casing loads, self-energizing resilient seal effects pressure-tight packoff.



Extreme casing loads result in only minimum deflection in pipe. Yield strength of pipe is not exceeded at joint strength.

Cameron

IRON WORKS, INC.

P. O. Box 1212—Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

The first "scatter" microwave system to be built for commercial use by a private firm will be installed soon by an oil company in South America.

The 200-mile path will be spanned by a single "trans horizon" hop. A conventional microwave system would require eight links. This "first" for a private installation follows closely receipt by American Telephone & Telegraph of permission to operate on a regular basis its 180-mile common-carrier scatter-link between Florida and Cuba.

Increases in state gasoline taxes are in prospect. The states will be wanting to raise funds to match federal road monies, which will increase as a result of the added 1-cent federal tax.

Some industry men are advocating that the O.I.I.C. head an intensified publicity campaign showing just how much of the consumer's gasoline dollar now goes to tax collectors of the various states and the dangers inherent in further increases.

Look for greater use of sewage-plant effluent streams by processing plants in the water-starved Southwest and Mid-Continent.

As streams continue to dry up and water tables drop, oil processors in these areas are eying Cosden Petroleum Corp.'s field-processing plant which treats and uses the waste stream from the Big Spring, Tex., sewage-disposal plant.

The spot to watch in Rocky Mountain exploration is Bisti-Black Rock field in San Juan County, New Mexico.

This San Juan basin bonanza is rapidly becoming a major discovery area as a result of big extension wells. The push here began several weeks ago and promises to gain momentum through the summer. Sinclair has announced a 24-wildcat program on the west side of the basin. Success at Bisti-Black Rock has raised hopes for similar Upper Cretaceous strat-trap prizes.

Rexforming is getting a shot in the arm from the continuing trend toward higher and higher octanes, underlined by the debut of 100-octane motor fuel. The announcement of Suntide's 15,000-bbl. Rexformer at Corpus Christi will be followed by another on the Gulf Coast soon. Still others are being seriously talked.

Reorganization of personnel by large and small oil companies is helping to solve the shortage of engineers and scientists. The companies are moving nontechnical employes in to take over some of the work of the technically trained.

The engineers like this. They've long contended that many in their profession were doing work that others could do. The change, they agree, will benefit everyone concerned.

Many observers believe that the latest defense-mobilization program of reducing Middle East imports isn't enough to bring domestic and foreign oil supplies in line in this country.

Most of the increases in imports in the past year [illegible]ome from Canada and Venezuela—unaffected by the latest plan—and further increases are in prospect.

The OIL AND GAS JOURNAL

JULY 9, 1956 • VOLUME 54 • NUMBER 62

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The Oil and Gas Journal, Published Mondays, copyright 1956, by The Petroleum Publishing Co. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. United States and foreign rates to the petroleum industry, 1 year $4, 2 years $7, 3 years $8.

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

. . . an integrated magazine serving an integrated industry

TECHNOLOGY–OPERATION

Drilling-Production

New Down-Hole Tool for Oil-Well Milling **80**
By Jack Chadderdon and C. O. VanNote, Jr.

Casing, tubing, liners, and junk of any form are being milled out of wells at rates far faster than formerly. This can be done by a new method of suspending particles of tungsten carbide in a tough but elastic matrix. Remedial work which formerly took days is being done in hours.

Corrosion Control of Gas-Lift Wells **100**
By Rupert H. Poetker and John D. Stone

Results indicate that a new method of squeezing inhibitor into the production formation is superior in efficiency and economy to the usual batch treatment for gas-lift wells.

What You Ought to Know about Producing Dually Completed Wells **108**
By J. Zaba, Henry Schaefer, and George E. O'Neal

A new turned-down coupling for use on parallel tubing strings offers new flexibility in operations for equipping wells to produce from dual zones.

Exploration

In Southwestern Ontario Gravity Survey Pays Its Way **86**
By W. B. Dyer

Gravity has proved to be a very effective tool in locating reefs in the southwestern Ontario area. The success ratio leaves no doubt that the survey has paid its way.

Refining-Processing

Stanolind Fights Corrosion in Sulfur-Recovery Plants **84**
By J. W. Kilmer, M. H. Rahmes, and H. L. Lawler

The principal cause of corrosion in modern sulfur-recovery plants is solution of corrosive gases in moisture condensed from the process stream. Solution of the problem may take two courses: (1) redesign equipment to minimize contact of the process stream with cool metal surfaces, and (2) external insulation of metal surfaces to prevent moisture condensation.

Ridding Process Waters of Caustic Solutions and Sulfides **95**
By A. G. Smith

An air-oxidation process has been developed which makes possible the disposal of sulfide-bearing waters without objectionable pollution of either the atmosphere or surface waters. The process involves conversion of sulfides to thiosulfates at elevated temperatures and pressures.

On-the-Job . . . In the Plants **115**

Training plant crews at Atlantic's Philadelphia refinery—Tickets mark leaky pumps—Grasshopper simplifies pipe handling.

Questions on Technology **117**

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Pipelining

Direct Efficiency Tests on Pipeline Pumps **76**
By Robert G. Deering

Direct measurement of input torque to a pump is possible with a new strain-gage torque coupling. The new device and a complete testing procedure are being used by Mid-Valley Pipeline Co. to test efficiency of centrifugal pumps and their drivers.

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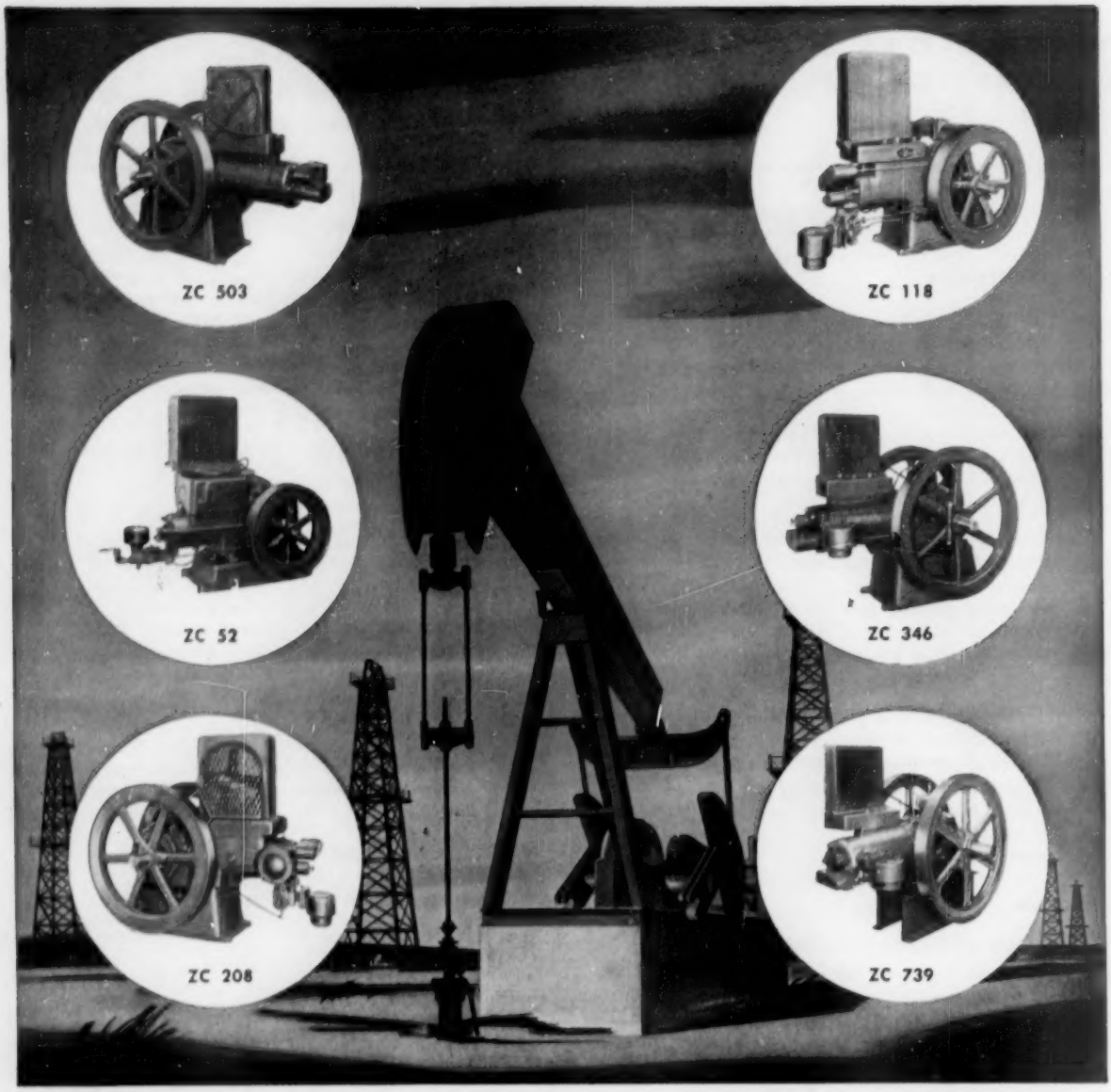

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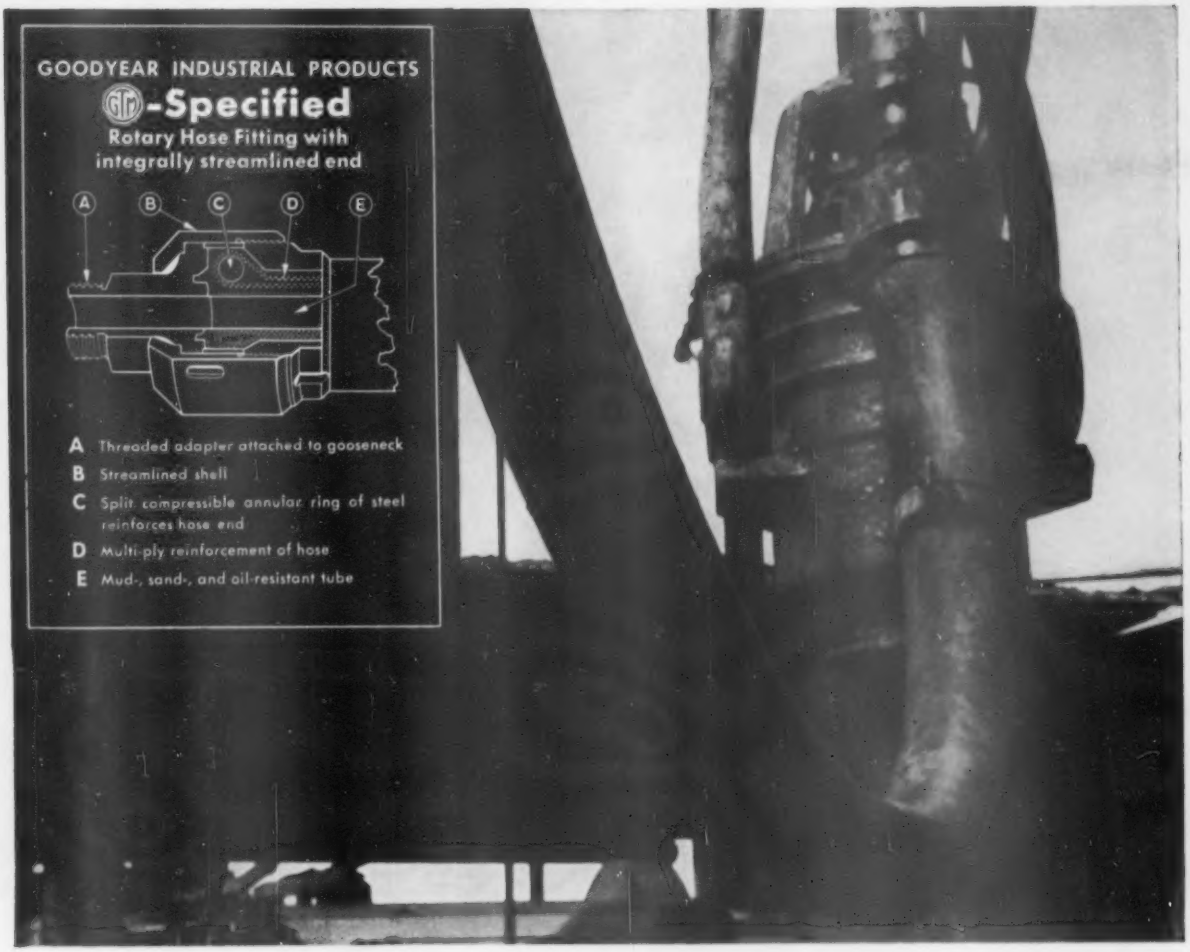


G.T.M.-Specified Rotary Hose "like new" after 16 wells

PICTURED above is a Style 3153H Rotary Drilling Hose specified by the G.T.M.—Goodyear Technical Man—for a Louisiana rig. At the last report, this hose had completed *16 wells for a total of over 111,000 feet of hole*—at pressures up to 2600 pounds *—and still was in like-new condition.*

The reasons? Every length of Goodyear 3153H Rotary Drilling Hose is hand-built with steel cable reinforcing and designed for drilling to depths of 15,000 to 20,000 feet, where bottom-hole pressures are extreme. Every length is factory-tested and guaranteed to 5,000 pounds. And the exclusive streamlined coupling (see blueprint) gives fast connections, full flexibility and maximum flow.

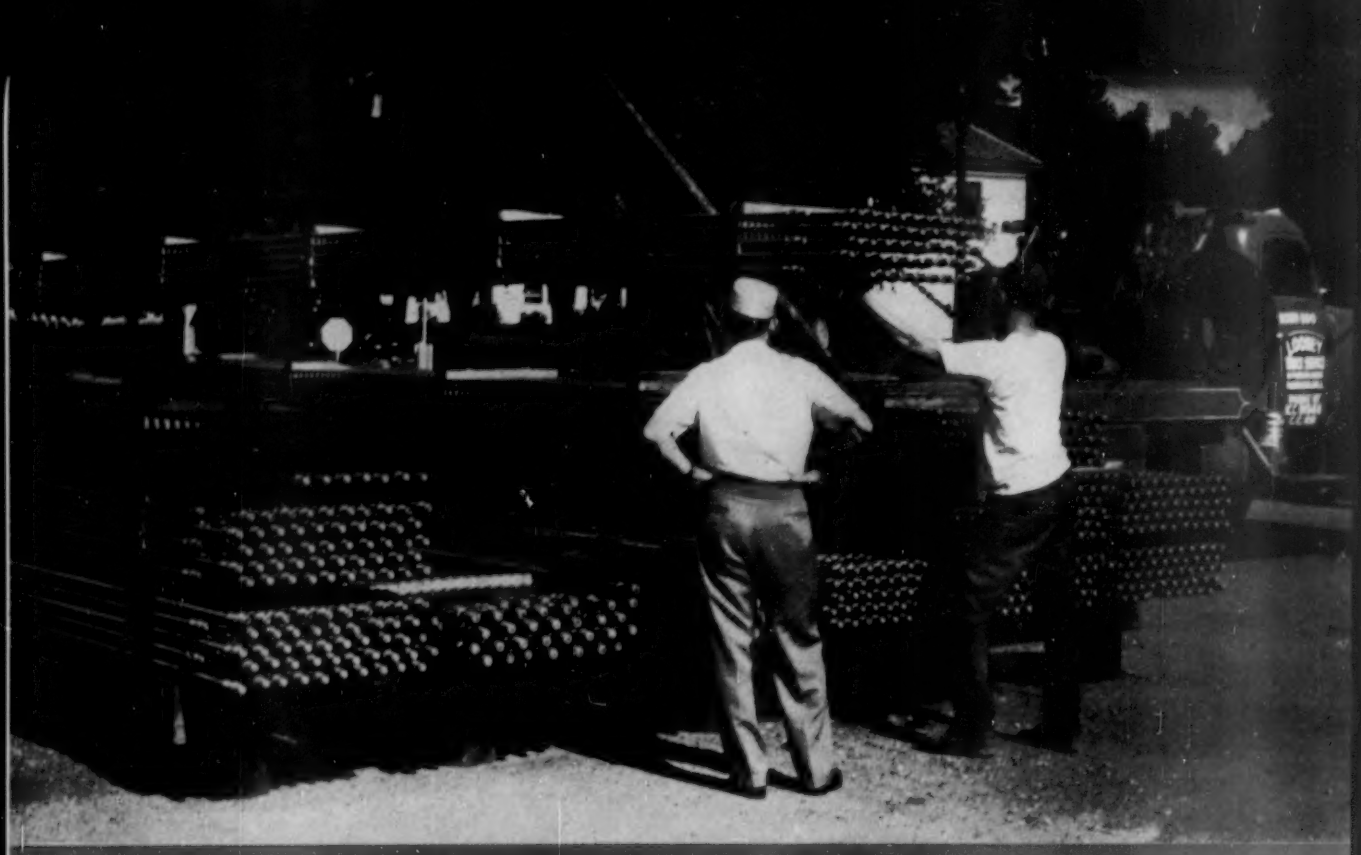
Style 3153H is just one of the many types of hose —and hose is just one of the types of industrial rubber —with which the G.T.M. can lower your drilling costs. Why not contact him today through your Goodyear Distributor or Goodyear, Industrial Products Division, Akron 16, Ohio.

ROTARY HOSE by

GOODYEAR

THE GREATEST NAME IN RUBBER

IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*



"Oilwell's" Grade "N" Sucker Rods—

even the ordinary is wrapped in extras—at no additional cost!

"Oilwell's" Grade "N" Sucker Rods are designed for use in ordinary non-corrosive wells. But we do not regard this grade lightly for that reason. Grade "N" Rods are given the benefit of many extra production treatments that make "Oilwell's" special purpose sucker rods perform so well.

After the bar stock has been roll-straightened and the rod ends have been formed, rods are heat-treated and normalized. They are then descaled by the shot peening method.

Machining of the sucker rod pins and of the case hardened couplings is extremely accurate, and frequent inspections keep tolerances well within A.P.I. limits.

After machining, Grade "N" Rods are subjected to "Oilwell's" *exclusive* vapor degreasing process to produce thoroughly clean rod surfaces to which protective coatings will adhere perfectly.

"Oilwell" rods are *not painted* . . . but a special phenolic enamel is baked on each rod. This plastic coating not only protects rods during shipment, but retards the adherence of paraffin in the well.

Grade "N" Rods are palletized to prevent damage during shipment . . . and are generally available from stock at "Oilwell" Branch Stores everywhere.

Typical car load of Grade "N" sucker rods.

Put Grade "N" Rods in your well and let them prove how much better they are than competitive rods for comparable services—and they cost no more.

OIL WELL SUPPLY

DIVISION UNITED STATES STEEL CORPORATION

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Broacher Serving All Oil Fields

USS

"OILWELL"

TRADE MARK

UNITED STATES STEEL

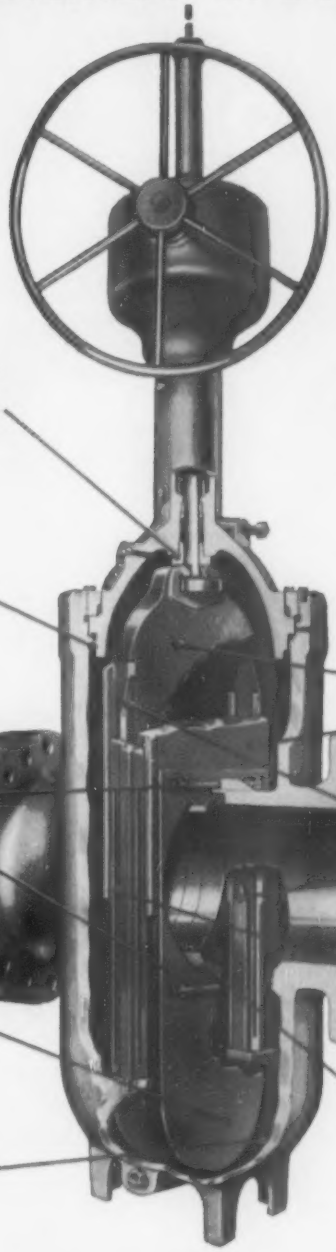
For Gas or Oil Pipelines . . .

HERE'S WHY OILMEN SPECIFY TYPE 49

Check these type **49** *features:*

- **Especially designed for pipelines handling crude oil, refined products, or gas.**
- **Easy passage for pigs or scrapers.**
- **No recesses to trap dirt.**
- **Install in any position, for flow in either direction.**
- **Complete line from sizes 2 to 30 inches in series 400 & 600.**

For more information, see your nearest Walworth Distributor or write to Walworth Company, General Offices, 60 East 42nd St., New York 17, N. Y. Ask for Circular 137.



Bonnet bushing screws into the bonnet and is tack-welded in place . . . guides the stem, also retains plastic packing which is adjusted by a packing screw.

Boltless, flangeless bonnet joint, sealed with ring gasket, stays tight at all pressures. This design saves room, weight.

Hard chromium-plated discs resist corrosion, abrasion.

Loading bars press disc shield plates axially to wipe discs clean while valve is closing or opening.

Leakproof closure, provided by wedging surfaces on each guide and sides of the discs. Wedging surfaces press discs against seat rings.

Disc shield plates contact disc faces at all times to prevent dirt from entering the body cavity.

Loading bars, incorporated on the disc guides, press the discs axially against the seat rings to provide wiping action between the disc and seat ring faces.

Valve needs no body-packing grease.

Backseated seat rings screw directly into body with perfect alignment. Stellite or bronze facing on ring.

Cutaway of a 16-inch Walworth Type 49 Cast Steel Pipeline Gate Valve

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Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto

For quick opening or closing Walworth manufactures lubricated plug valves for pipelines in sizes to 30-inches . . . pressures to 5000 psi and for vacuum service. Ask for literature.

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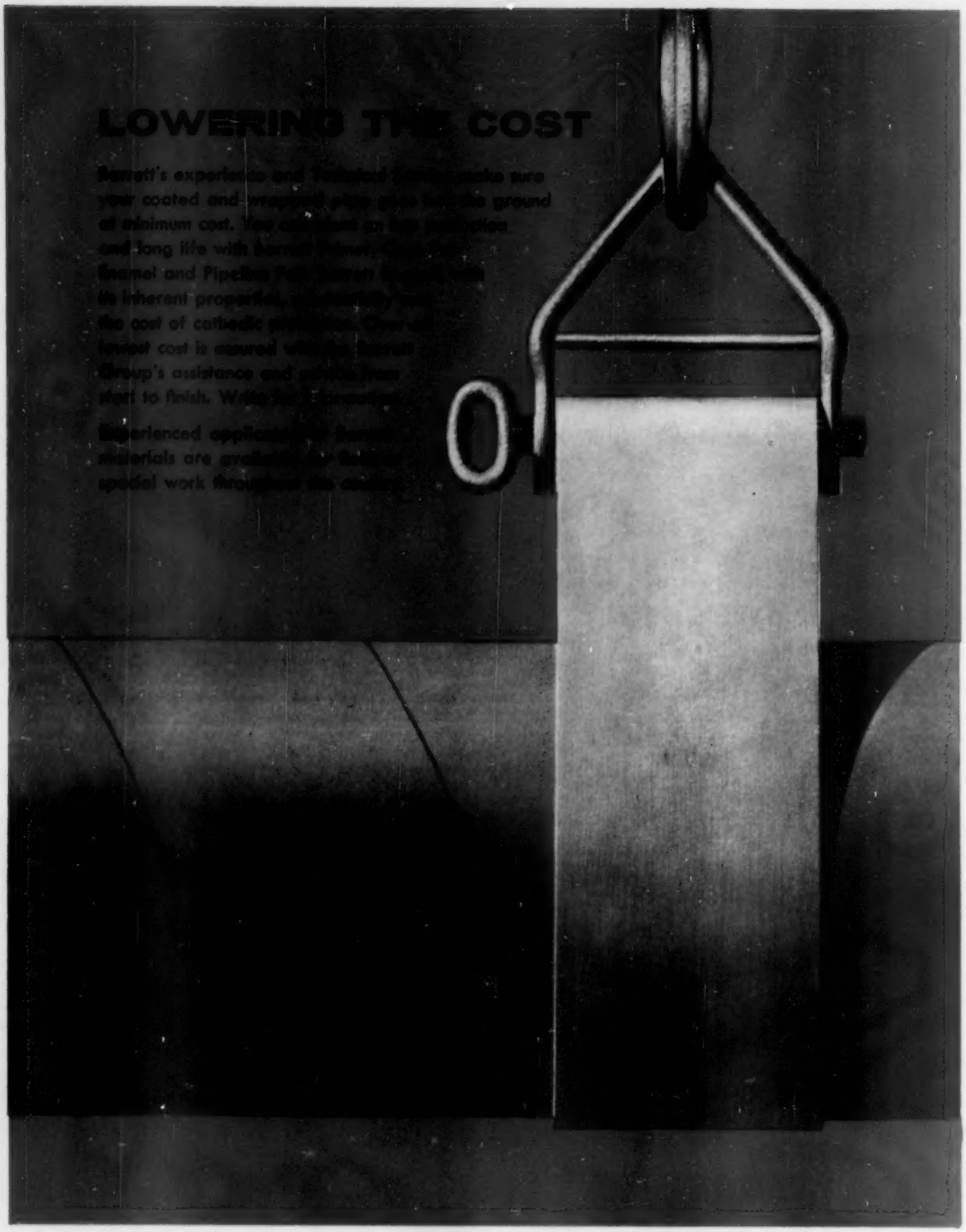

Barrett

PROTECTIVE COATINGS

BARRETT DIVISION, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y. In Canada: The Barrett Company, Ltd., 5551 St. Hubert Street, Montreal, Que.

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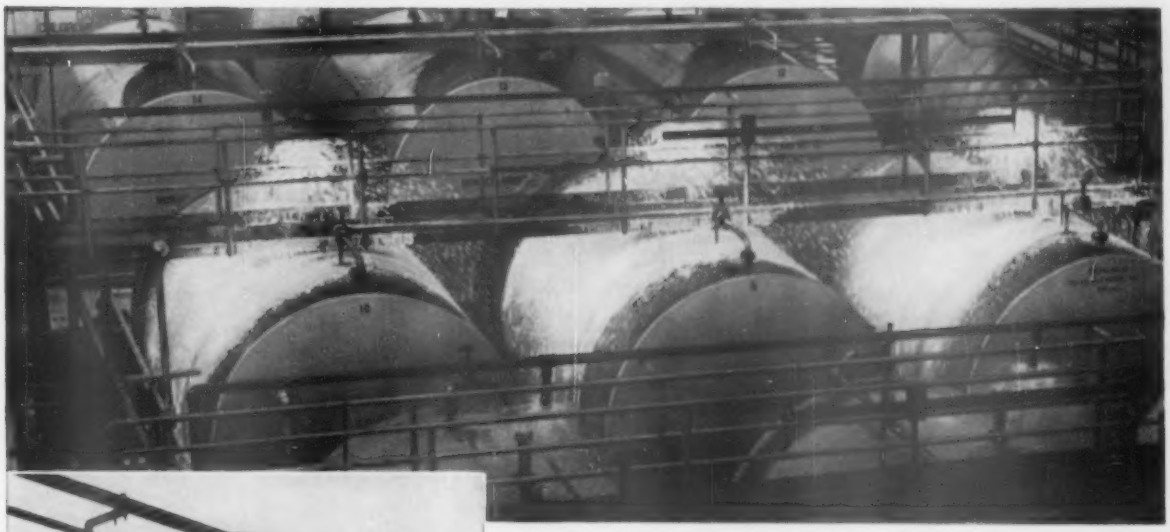
Allied Chemical

FLAMMABLE CHEMICAL STORAGE SAFEGUARDED BY SPECIAL GRINNELL SYSTEM



Protection of stored alcohol and monochlorobenzene is entrusted to a foam system installed by Grinnell. In the event of fire, flame-smothering foam covers the manhole, the most hazardous part of the tank; at the same time building up a foam blanket in the dyked area at base of tanks to kill fire there. (See test operation photos above.)

At the Rohm & Haas Company, mechanical foam, one of many special Grinnell fire protection systems, is used for fire hazards involving flammable liquids . . . such as in tank storage of chemicals; oil and paint rooms; loading racks; creosote tanks; pump houses; and processing rooms. Mechanical foam operates by shutting off the oxygen from the flammable vapors — and by insulating against the heat of the fire. It is flexible and adaptable; floats on liquids, flows over and around obstacles, clings to solids.

Call on Grinnell for help with your fire protection problems. Grinnell engineers are trained to evaluate your property and to advise on the proper system for your hazard. With a full range of equipment and more than 86 years experience in fire protection work, you are assured of unbiased recommendations which will be fitted to your exact needs. Grinnell Company, Inc., 256 West Exchange Street, Providence, R. I.

GRINNELL

Manufacturing, Engineering, and Installation of Fire Protection Systems Since 1870

There's a GRINNELL Fire Protection System for every fire hazard

- **Automatic spray sprinklers** — wet pipe, dry pipe, and Simplex systems
- **Deluge spray sprinklers, rate-of-rise detection** — Multitrol wet or dry pipe systems
- **Emulsion and vapor dilution extinguishment** — Mulsifyre and ProtectoSpray systems
- **Water spray for cooling, insulation, and controlled burning** — ProtectoSpray systems
- **Mechanical foam blanket** — ProtectoFoam systems
- **Carbon dioxide blanket** — C-O-Two systems
- **Dry chemical systems**

The right Axelson pump will give you more oil and less trouble.

Your J&L store has that pump and can prove its performance with local case histories.

Let J&L help. Axelson pumps are made and can be assembled in infinite variety. No J&L customer is ever obliged to use a square peg in a round hole.

Nor does J&L ever consider an Axelson sale final. J&L pump repair shops stand by in the United States and Canada with parts and service. Never junk an Axelson. Never accept a substitute.

Pump for more profit . . . get J&L on the telephone now.

J&L Casing and Tubing, Cabot Pumping Units, Axelson Sucker Rods — these are also select and important elements in the proven J&L formula for MORE OIL, LESS TROUBLE.

Axelson deep well plunger pump, "TLE" tubing liner type.

J&L

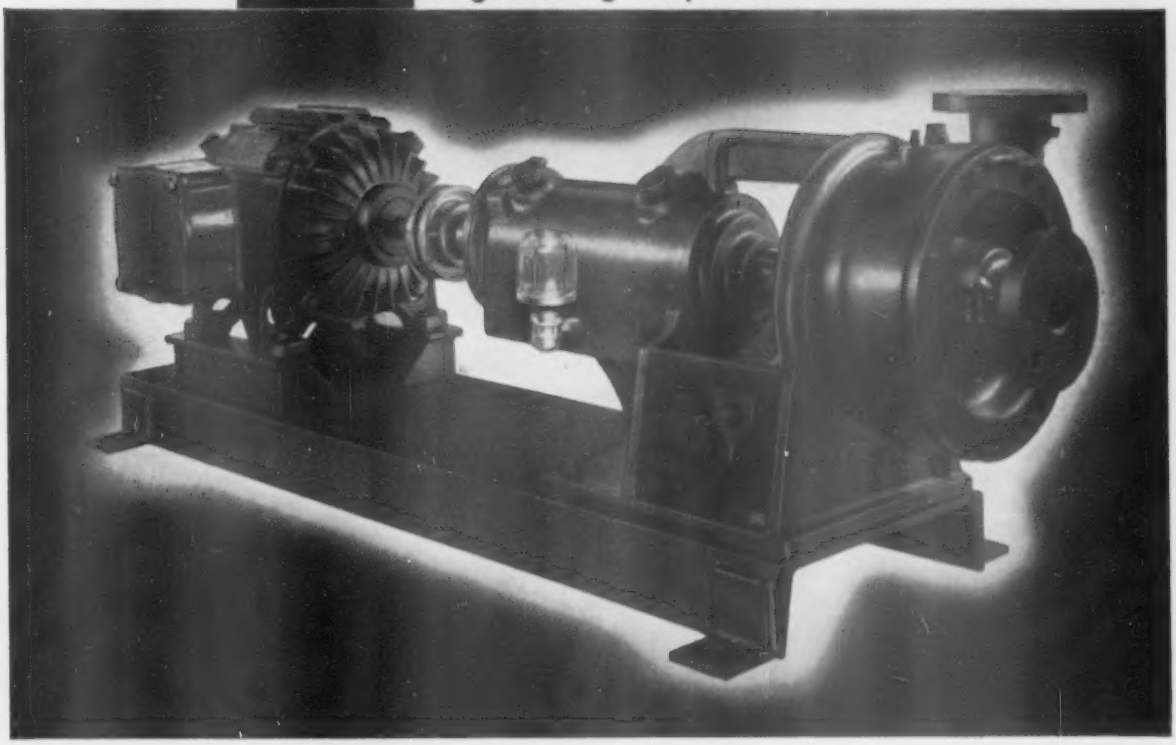
Profit Formula for Producers

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

There's **MORE** Engineering help from Allis-Chalmers



Get modifications you need

with Allis-Chalmers FRAME-MOUNTED PUMPS

EXACT MECHANICAL MODIFICATIONS . . . right combination of materials...all are designed into the Allis-Chalmers pump *you* need to get lowest cost per gallon pumped. With a wide variety of optional constructions available, A-C pump specialists can build *your* pump to do any one of many refinery jobs.

Costs Less, Too

Despite custom design, the Allis-Chalmers pump costs hundreds of dollars less than costly "special" refinery pumps. Find out about its many possible applications and check these custom features:

- Available materials include iron, bronze, stainless steel, high nickel alloys and others.
- Variety of sealing arrangements are available — external seal, external grease seal, water-cooled stuffing box, single inside mechanical seal, single outside mechanical seal, double inside mechanical seal.
- Shaft is made of either high-grade carbon steel or stainless steel. Shaft sleeve is furnished in bronze or a special material — according to your requirements.

Allis-Chalmers can supply a complete pumping unit — pump, motor, drive, and control. For more information, contact your nearby A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

A-4996

ALLIS-CHALMERS

CONSTRUCTION COSTS UP?

Here's how to save 20% in joining a pipeline

Armco Line Pipe is supplied in standard 50-foot lengths instead of the usual 40-foot or double-random lengths. This means at least 20 per cent fewer field joints. Line-up and welding time are reduced and you have fewer sections to handle.

What's more, the wide range of diameters—6 to 36 inches—and wall thicknesses—$^{9}/_{64}$ to ½-inch—available in Armco Pipe allows you to use the right size for your particular requirements. No need to buy "oversize" pipe.

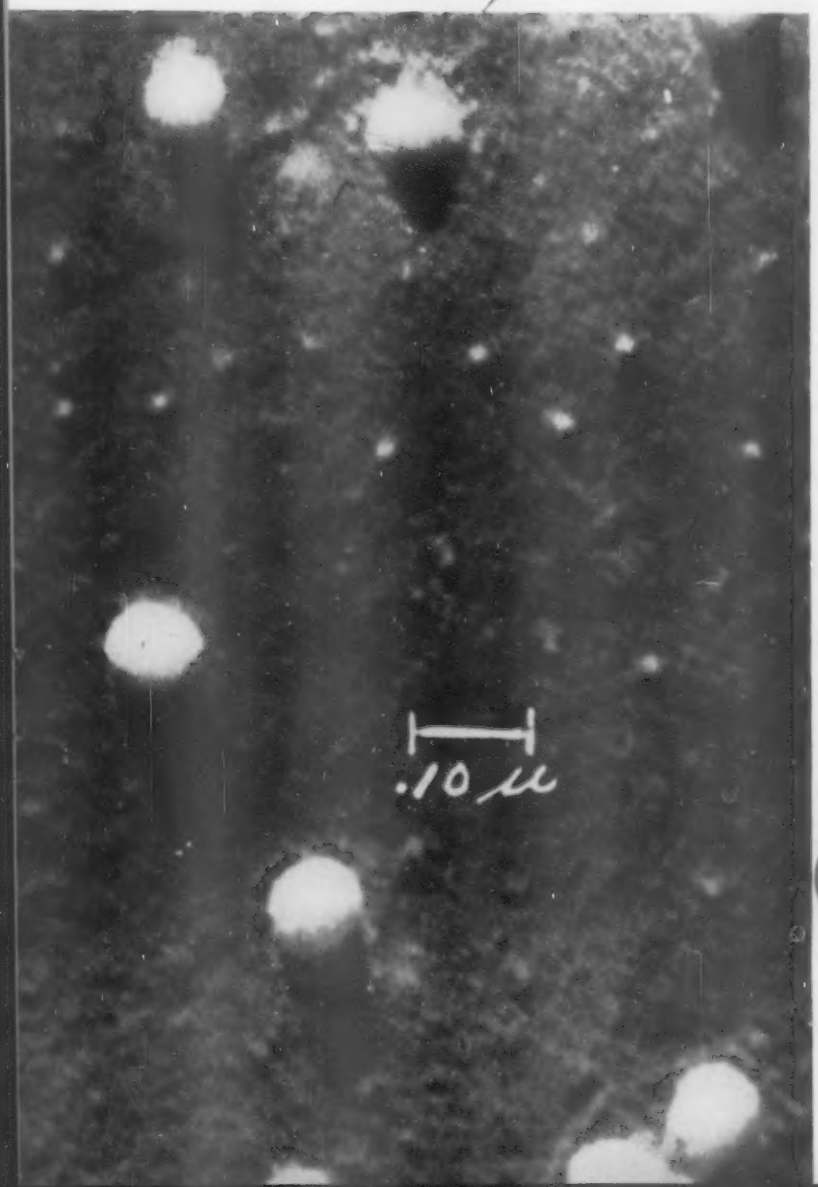
Use Armco Welded Steel Pipe for requirements in the Natural Gasoline and Natural Gas Divisions and wherever else you need dependable line pipe. Write us for data. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 3956 Curtis St., Middletown, O. 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

Armco Welded Steel Pipe

ARMCO

MEASURING THE UNSEEN

Influenza virus magnified 78,570 times by an electron microscope. The unit of measure shown, 0.1 μ, is 1/10,000 millimeter.



Tuboscope research in its field has been as imaginative and rewarding as the electron microscope has been in its field.

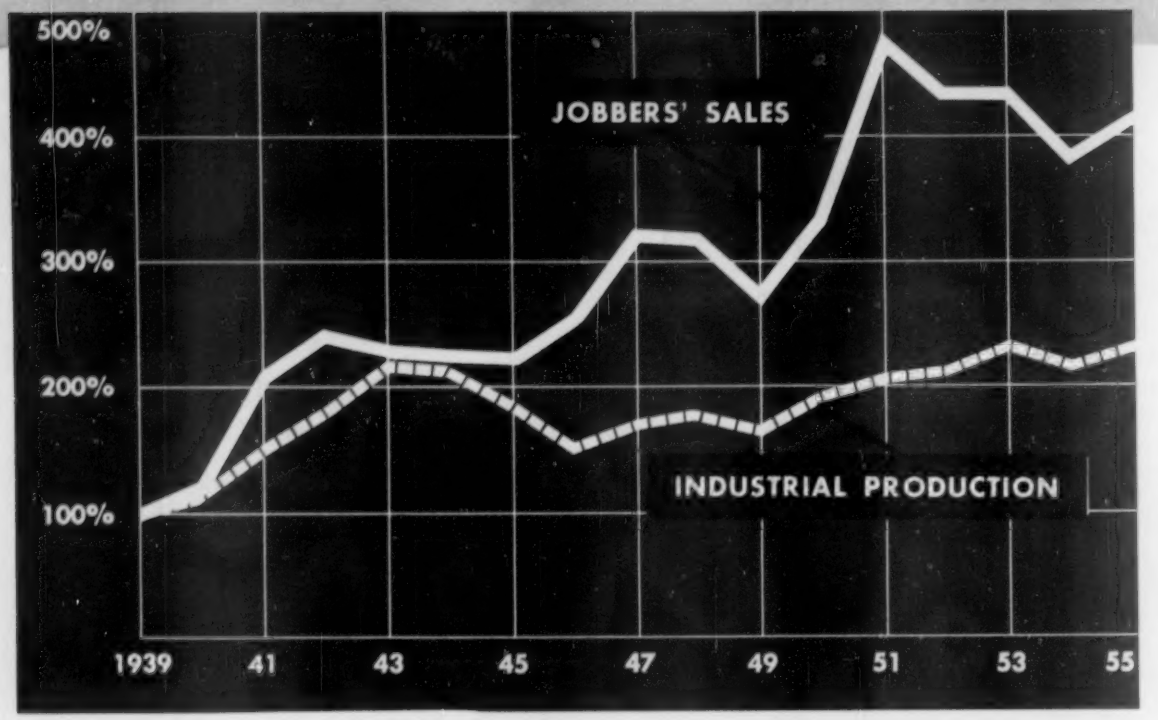
With instruments developed by Tuboscope research, Tuboscope technicians are able to measure the unseen ravages of wear, fatigue, and corrosion in oilfield tubular goods. These instruments, coupled with Tuboscope's years of experience, assure you of the best and the newest in proved methods of non-destructive inspection in the field.

The important elements of bottom hole temperature and pressure can likewise be measured by the Subsurface Engineering Division.

Tuboscope COMPANY

2919 HOLMES RD.
HOUSTON, TEXAS

JOBBERS Prevent Hardening of the ECONOMIC ARTERIES

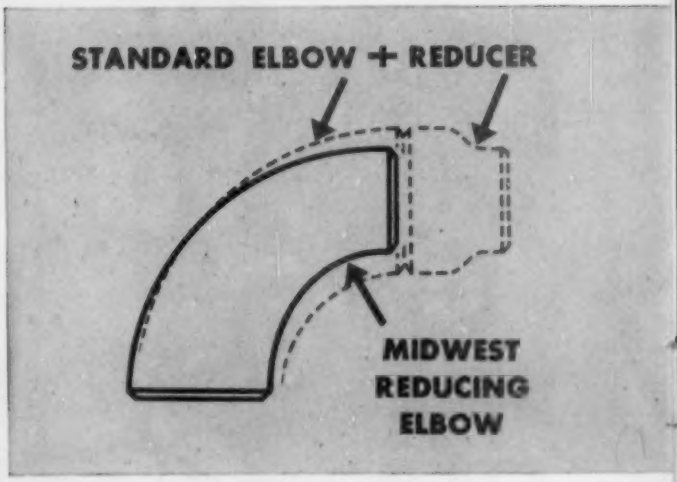


The chart above shows that the jobber is now handling a larger share of industrial goods than ever before. Users are finding it to their advantage to look to him for more of their needs. The jobber reduces the user's inventory, assures prompt delivery, provides technical assistance when needed . . . and many other benefits. Are you using him to your own best advantage?

MIDWEST

Jobbers Save You Money, Time and Trouble on Welding Fittings

Midwest Jobbers have the most complete line of welding fittings . . . which often permits them to improve or simplify piping. Only Midwest jobbers offer you a full size range of reducing elbows that take the place of two fittings . . . a straight elbow and a reducer, thus saving space and one weld. There are many other advantages to be gained by using Midwest Welding Fittings . . . see for yourself . . . ask for Catalog 54.



MIDWEST
PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Clifton, N.J. and Los Angeles

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7416

avoids trouble **in deep hole testing**

HALLIBURTON'S EXPANDING SHOE PACKER

Easier, faster and more successful testing results from the Packer that's built to avoid trouble

- **Less Drag in and out of Hole**

  ...because the amount of drag is decreased by using a smaller diameter Packer than would normally be required.

  ...because pulling and jarring to release the Packer are minimized.

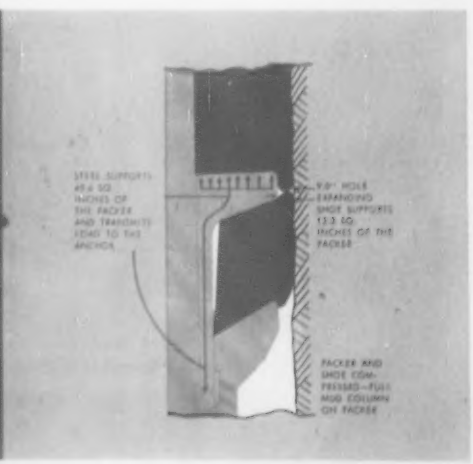
- **Comes out of Hole intact**

  ...because the Packer is prevented from extruding around the lower shoe. This eliminates the necessity of having to pull the lower shoe through the Packer to get loose. Less rubber is left in the hole.

- **Fewer Misruns... More Successful Tests**

  ...excellent condition after use shows that Halliburton's Expanding Shoe Packer can be set and re-set until a satisfactory test is completed. The function of the lower shoe is to support the overflow of the Packer and prevent it from thrusting out beyond its working limits. Unique design substantially reduces the load on the Expanding Shoe which is constructed of oil-resistant, heat-resistant rubber, much harder than the rubber packer it helps to support.

  These are but a few of the field-tested reasons why Halliburton's Expanding Shoe Packer offers an effective solution to many testing problems under the most rugged deep hole conditions. Next time, use the Packer that's built to avoid trouble... phone your local or district office of the Halliburton Oil Well Cementing Company.



COMPLETE DATA SENT ON REQUEST—Add this valuable information to your Halliburton Service File

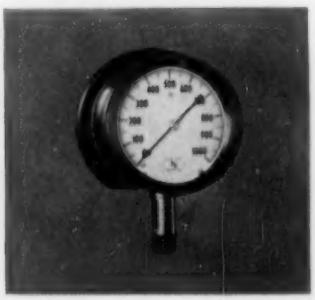
HALLIBURTON TESTING SERVICE

Why does the BOURDON TUBE in the ASHCROFT DURAGAUGE insure sustained accuracy?

FOR FAST SERVICE, get in touch with your Industrial Supply Distributor. He is fully acquainted with Ashcroft Duragauges and their proper selection for all kinds of applications.

8 TUBE MATERIALS permit selection of the *best metal* for particular service conditions. These materials include phosphor bronze, alloy steels, "K" Monel, stainless steels, and beryllium copper.

Every Bourdon tube used in the Ashcroft Duragauge is extra-wide – highly sensitive to slight pressure changes. Socket and tip joints are welded or brazed, then stress relieved after assembly, to assure maximum safety and uniform structure for highest corrosion resistance and strength. Each tube assembly is "whip tested" at pulsating pressures approximately 50% higher than its pressure rating to insure calibration stability.



The Ashcroft Duragauge is available with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. A choice of case designs and materials, dial sizes and pressure ranges readily satisfy the most exacting requirements. Whatever the working pressures or corrosive conditions of your operations, specify Ashcroft Duragauges and be sure of highest sustained accuracy and long service life.

1850 ASHCROFT U.S.A.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

Southwest

HEAVY DUTY PACKAGED GAS COMPRESSOR FOR UNDER 250 H. P.

Here is the heavy duty gas compressor the industry has needed. Not a stripped down model, but a rugged packaged plant designed and built with the same thoroughness that Southwest puts in its larger units. The Cooper-Bessemer compressor cylinder has interchangeable liners and is interchangeable with larger compressors. The same vertical air discharge cooling is used as in integral packaged gas compressor plants. The engineering design features proved by Southwest in integral units are incorporated in this, the first quality packaged gas compressor in the low horsepower field.

FOR GAS LIFT, GAS BOOSTER, PRESSURE MAINTENANCE AND SIMILAR PROJECTS.

SOUTHWEST INDUSTRIES, INC.

Post Office Box 7773, Houston 7, Texas

NOW . . . you can fill casing from bottom more efficiently than ever!

RECTOR Type "O" Fill Shoe and Fill Collar

Used in conjunction with each other, Rector Type "O" Fill Shoe and Fill Collar provide an automatic constant fill; increase operating flexibility while running casing and during cementing operations. They reduce running time, increase safety, efficiency and economy and minimize the danger of sticking pipe.

RUNNING TIME REDUCED because manual fill is eliminated.

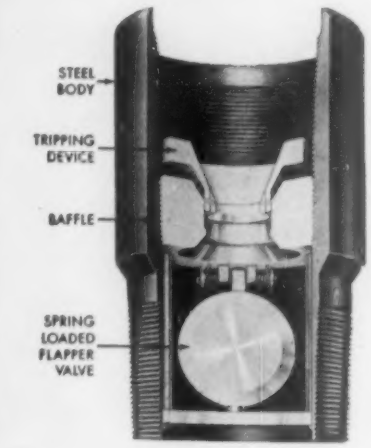
PIPE STICKING MINIMIZED because no "stops" are required to fill from top.

REDUCES PRESSURE SURGE and danger of breaking-down formations, causing lost circulation and loss of drilling fluids.

UNRESTRICTED PASSAGE OF FLUID permits greater volumes through shoe and collar at reduced pump pressures with higher velocity in annulus.

ORIFICE FILL AFTER CIRCULATION. You can stop and circulate as often and long as desired with continued orifice fill when running is resumed.

CONVERTS TO FLOAT WHEN DESIRED, by tripping flapper valve in collar which provides positive closure.

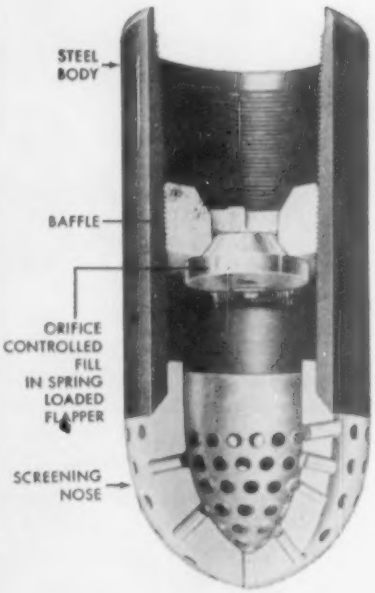


• Internal parts of both shoe and collar are a special aluminum alloy which has greater strength and abrasion resistance, plus easier and faster drill out.

The Type "O" Fill Shoe has a perforated aluminum alloy nose and baffle which is equipped with spring-loaded flapper valve with orifice choke. Orifice inserts are available in various choke diameters engineered for all pipe sizes.

The Type "O" Fill Collar has an aluminum alloy baffle, spring-loaded flapper valve and shear pin assembly for holding valve open. It functions as a back pressure valve or float collar. The flapper valve can be closed at any time by dropping a trip ball in casing at surface. At 650 p.s.i. pump pressure the ball releases flapper valve to provide a positive closure. Ball gravitates, or is pumped into nose of shoe.

If casing is run to total depth with orifice fill, ball is not used. Seating of cement plug on fill collar releases and closes flapper valve which then acts as back pressure valve, providing positive flow-back control.



25

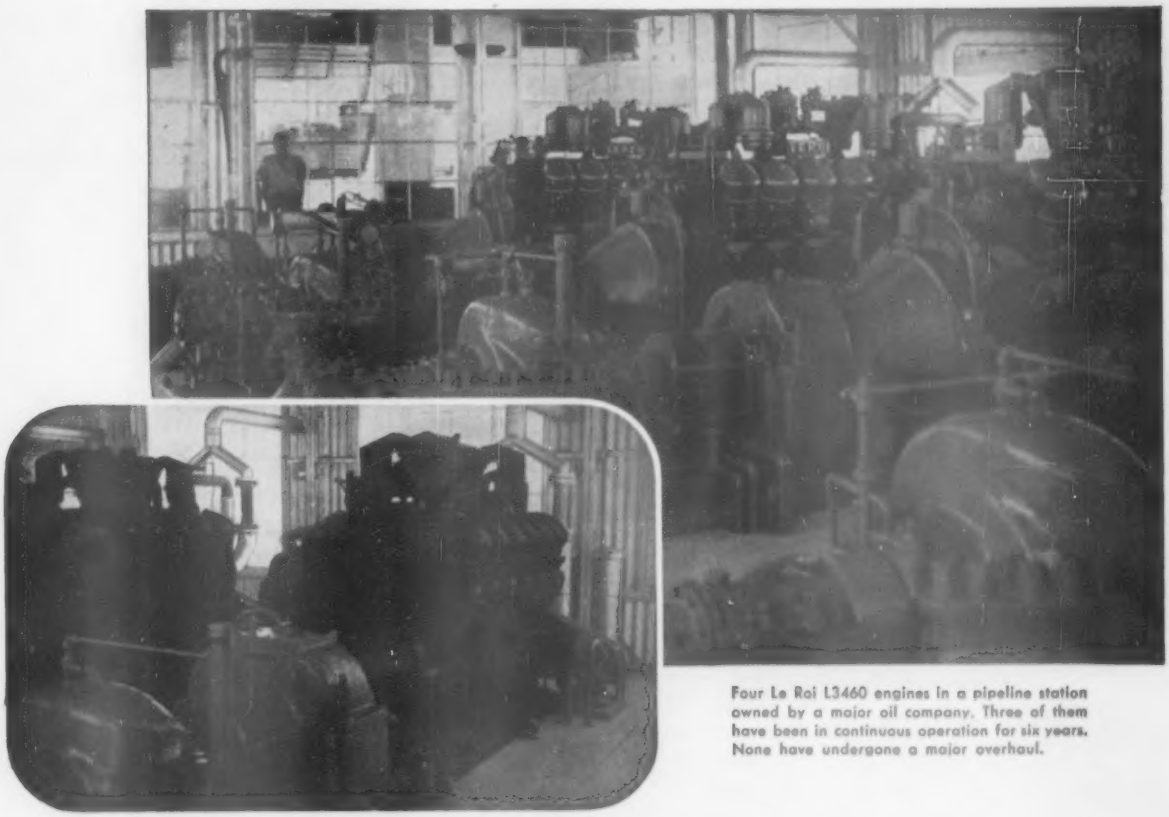
RECTOR WELL EQUIPMENT COMPANY INC

MAKING THE OIL INDUSTRY SAFER

1100 NORTH COMMERCE ST., FORT WORTH, TEXAS

Houston Plant: 2218 Commerce St.

REPRESENTATIVES IN ALL ACTIVE FIELDS



Four Le Roi L3460 engines in a pipeline station owned by a major oil company. Three of them have been in continuous operation for six years. None have undergone a major overhaul.

Power-Packed Pipeline Station

. . . uses Le Roi L3460's to provide plenty of low-cost pumping power

Le Roi's L3460 with 600 max. hp. and its bigger brother, the L4000 with 655 max. hp., are ideal for pipeline service on many counts. Here's why:

Plenty of power with good fuel economy — These engines develop 600 and 655 max. hp. with rock-bottom fuel consumption, and can be run on natural gas, gasoline, or butane. Advanced design manifolding, low friction bearings, and low power loss to accessories, all contribute to unusual operating economy.

Long engine life—Perhaps the best proof of this statement is found in the trouble-free performance experienced by users in installations like the one shown above. Basically the L3460 and L4000 are compact, high-output engines designed with short stroke to give you greater horsepower and speed, without compromising engine life. And that's exactly what they do for you.

More comfortable operating conditions—Water-cooled exhaust manifold cuts down engine heat in operating areas, yet provides fast engine warm-up. The smooth, clean lines of these engines prevent dirt from collecting —that's why they are so easy to keep clean.

Compact V-12 design packs a lot of horsepower in a small space—to give you more horsepower per dollar. This, plus vibrationless performance, reduces foundation costs, simplifies installation.

We think that if you see an L3460 or L4000 in operation you'll agree that they provide the answer to low-cost pumping power. Have your supply house or Le Roi distributor show you one at work. Bulletins are available upon request—just write us.

P-140

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS · TRACTAIR · STATIONARY AIR COMPRESSORS · AIR TOOLS · ENGINES

Good People to Know
-Gaso Distributors*
They have the knowledge it takes to make sound recommendations. They're service-minded, with stocks that assure quick delivery of pumps and parts. Competent and cooperative, they're another reason why GASO Pumps are first in their field.
*NOTE THEIR NAMES BELOW
GASO

SERIES 3600—for water-flooding, salt water disposal, oil well acidizing, oil well fracturing, crude oil gathering systems. Pressure range: Fig. 3671, 1575 to 800 PSI; Fig. 3670, 6250 to 1935 PSI.

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GASO PUMPS

for every oil industry need

GET GASO DEPENDABILITY IN WATER FLOODING, TOO

No. 1 on the List

for small forged steel gate valve jobs

CHAPMAN LIST 960

You'll find more Chapman List 960 valves on more jobs than other small forged steel gate valves. For standing up and keeping maintenance costs down it's tops, by far, on the valve man's preference list. The reasons are sound and several.

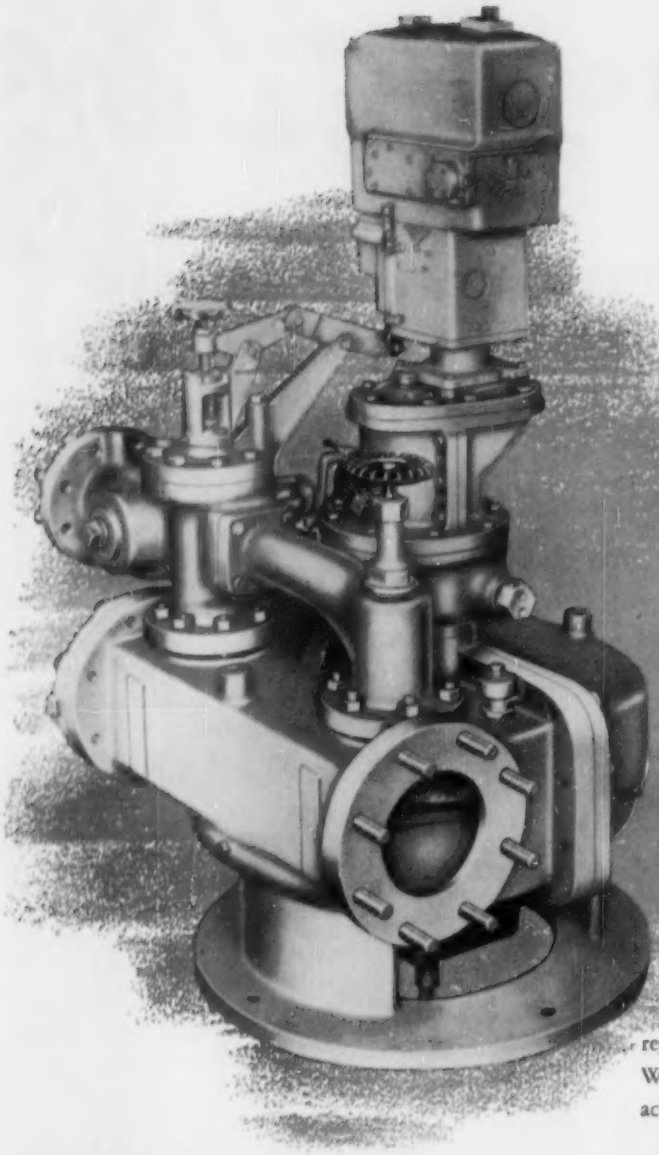
Wedge gate faces are super hard . . . hardened to 800 Brinell by Chapman's exclusive Malcomizing process. They won't . . . *they can't* seize or gall. Easily replaceable seat rings are hardened stainless steel. Wear on seating surfaces is brought to a minimum. Bolted follower on the outside screw rising stem type has no exposed threads on its yoke . . . nothing that's easy to corrode.

Made to take . . . and stand up under . . . pressures from 380 psi at 1000° F. to 2000 psi at 100° F. (For higher ratings use Chapman List 990 valves.) Sizes from ¼″ to 2″ in many different alloys. You can have either rising stem with yoke or rising stem with inside screw. And, depending upon your needs, the Bonnet joint is either ground metal-to-metal or gasketed.

Catalog 10 has full information. It's required reading for men interested in valves. Write for your copy today.

THE CHAPMAN VALVE MANUFACTURING CO.
INDIAN ORCHARD, MASSACHUSETTS

where speed control counts



D-H *turbines deliver accurate speed control where you need it.*

Ideal for all drives requiring extremely close speed regulation, Dean Hill Steam Turbines equipped with Woodward Type PG Governors guarantee maximum accuracy.

This governor is adaptable to either the vertical or horizontal Dean Hill Turbine, and unlike most types of governors, it is "isochronous", holding a steady speed within a band of 0.1% to 0.03% over an extremely wide range of turbine speed, regardless of the load on the pump. All DH Turbines come equipped with over-speed trip valve.

For further information on D-H Turbines and optional accessories

write today for Catalog 500.

DEAN D-H HILL PUMP COMPANY

Pump and Turbine Engineers Since 1893

Indianapolis 7, Indiana

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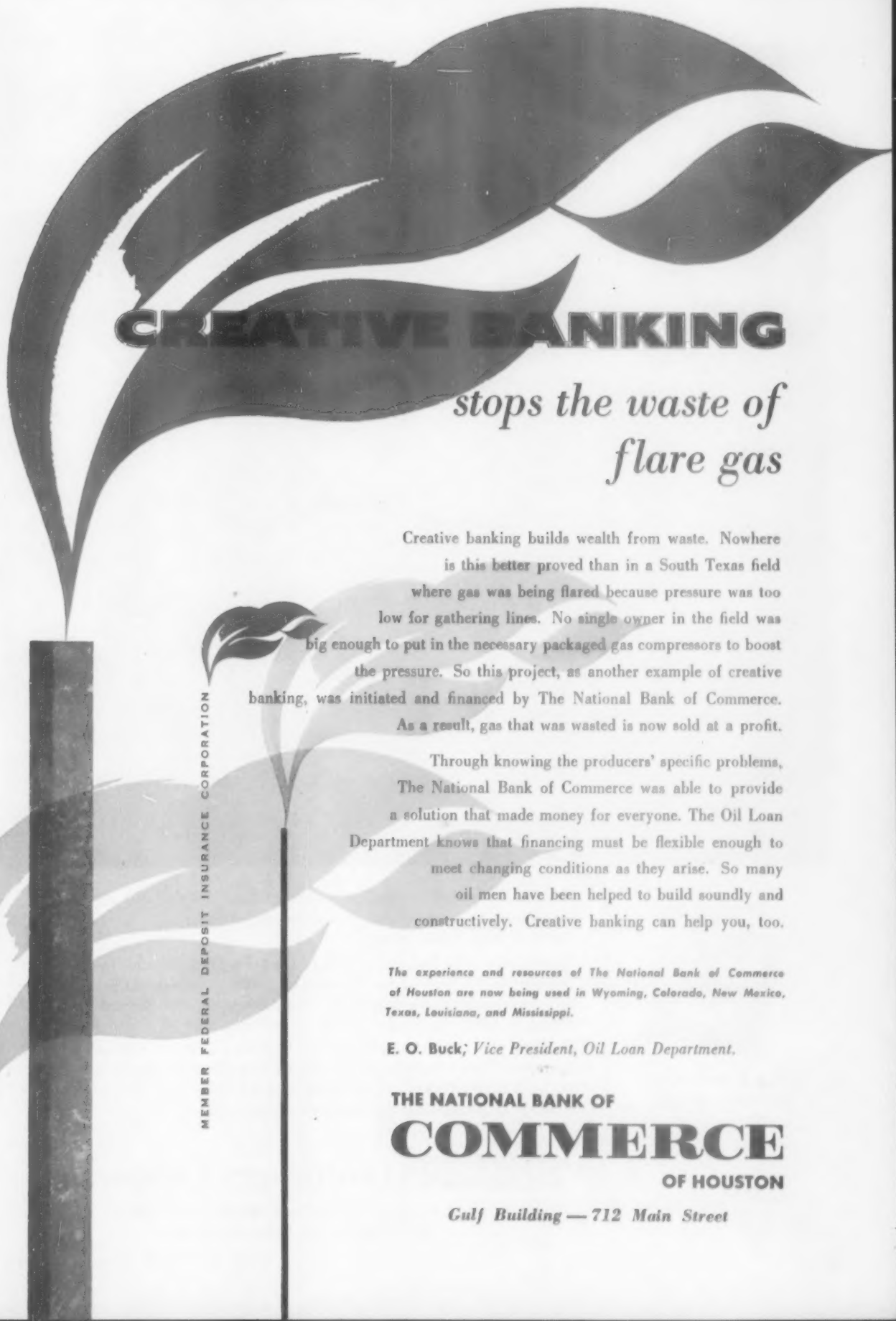


CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

COMMERCE

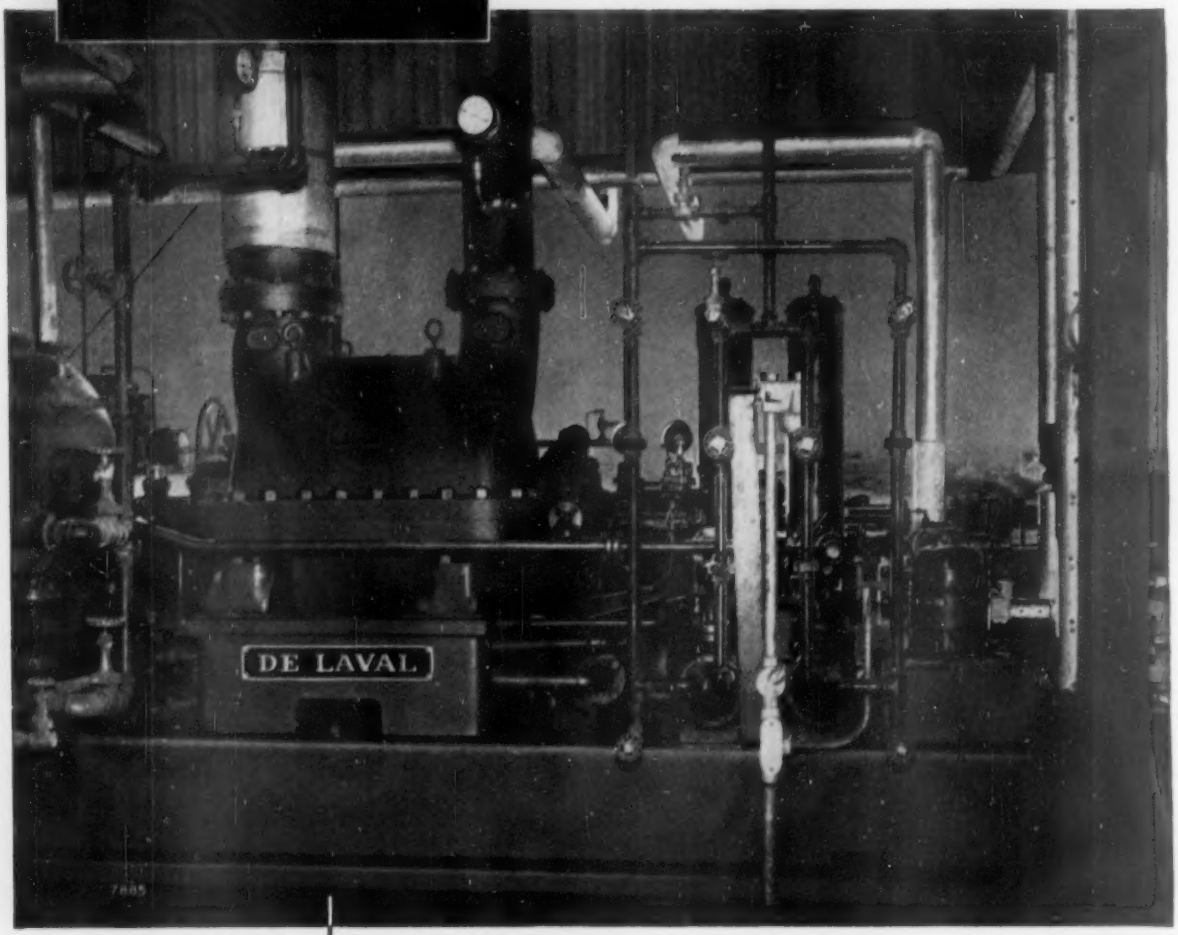
OF HOUSTON

Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

DE LAVAL CENTRIFUGAL COMPRESSOR

handles propane-butane for M. W. Kellogg alkylation unit



New Bulletin 0504 gives complete data

On stream at a plant of a large mid-western refiner, this De Laval unit compresses the propane-butane mixture to prepare it for an M. W. Kellogg alkylation unit.

Inlet volume of the De Laval centrifugal compressor is 3,040 cubic feet per minute. Inlet pressure is 18 psia, and discharge pressure 85 psia. This compressor is equipped with De Laval contact-type oil seals. The unit is driven by a 600 bhp turbine running at 7,400 rpm.

De Laval compressors are designed and built for heavy duty continuous operation. Rugged, horizontally split casings, individually designed impellers, perfectly balanced rotors and externally mounted, cylindrically seated bearings assure optimum performance and long service.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY
810 Nottingham Way, Trenton 2, New Jersey

DL 999

DOW

ELIMINATE OIL FIELD HAZARDS

practice good housekeeping with Dow weed and brush killers

Brush and weeds don't belong in vital oil areas. Whether they're a fire hazard, unsightly, a safety problem, or just a nagging nuisance, eliminate them with Dow brush, weed and grass killers.

Radapon*, containing dalapon sodium salt, gives you season-long control of grasses. For extended control of both grasses and broad-leaf weeds use Baron®. Both of these systemic killers act through the leaves . . . down through the plant system . . . right into the roots.

Dow brush killers keep your above-ground pipelines visible . . . accessible . . . making patrol and maintenance easier. A wide variety of specialized brush killers offers you positive control of local species.

You can plan a complete vegetation-control program at low cost with Dow specialized herbicides. We'll be glad to help you work out a program to fit your needs. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland,Michigan.

*Trademark of The Dow Chemical Company

you can depend on DOW AGRICULTURAL CHEMICALS

DOW

ANNOUNCING the new SUPER GIANT RIG...

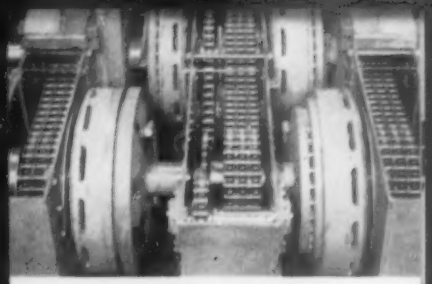
unquestionably...the most advanced and modern rig in the world today

YOU OWE IT TO YOURSELF TO INVESTIGATE THIS NEW AND MODERN RIG BEFORE BUYING

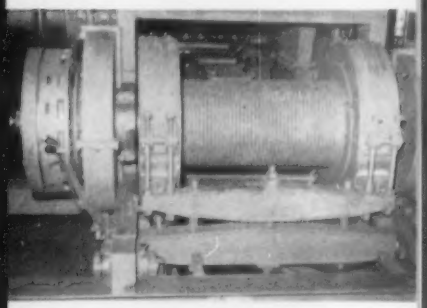
Write for Full Details

WILSON MANUFACTURING CO., INC.

WICHITA FALLS, TEXAS • the home of RED IRON



- *With New Three Speed and Reverse All Friction Clutch Transmission*
- Available with Parkersburg 22" Single Hydromatic Brake Mounted on Transmission *with 6 Speeds Between Drum and Brake* — The Best Hydromatic Brake Arrangement Yet Devised!



- With New Beam Equalizer, Single Nut Adjustment Lever Type Brake which CANNOT KICK.
- Oil Bath Drum Drive Chains Outside Frame
- High and Low Clutches on End of Drum Shaft
- Heavy Plate Chain Cases and Covers

be modern-

buy Wilson

But Not SOUTHWESTERN

If you use pipe around salt water . . . or if you use pipe to dispose of salt brine . . . you know ordinary pipe quickly gives in to the ravages of corrosion . . . but not Southwestern Plastic Pipe.

Here is the pipe that can even carry caustic acids without corrosion or deterioration. It's "Rust-Proof" Pipe . . . not subject to rust, rot or electrolytic corrosion.

If salt water causes problems at your wells, or if you have any problems of corrosion, get the facts on Southwestern Plastic Oil Field Pipe.

Write today for free literature on the various types of Plastic Pipe manufactured by Southwestern. You'll find real economy now . . . but even more important is the savings for years to come. Mail the convenient coupon now.

SOUTHWESTERN
MANUFACTURES
KRALASTIC PIPE
P. V. C. PIPE
TENITE
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POLYETHYLENE
PIPE
CHEM-WELD DRAIN
PIPE
each type designed to do specific jobs better

look for this sign at your oil field supply store

Td. Mk. Applied For

We are interested in Plastic Pipe for use in_____

In this application, temperature will be about_____

with pressures of_____

☐ Have Someone call on us ☐ Send Free Literature

Please Print Or Write Plainly

Company_____

By_____

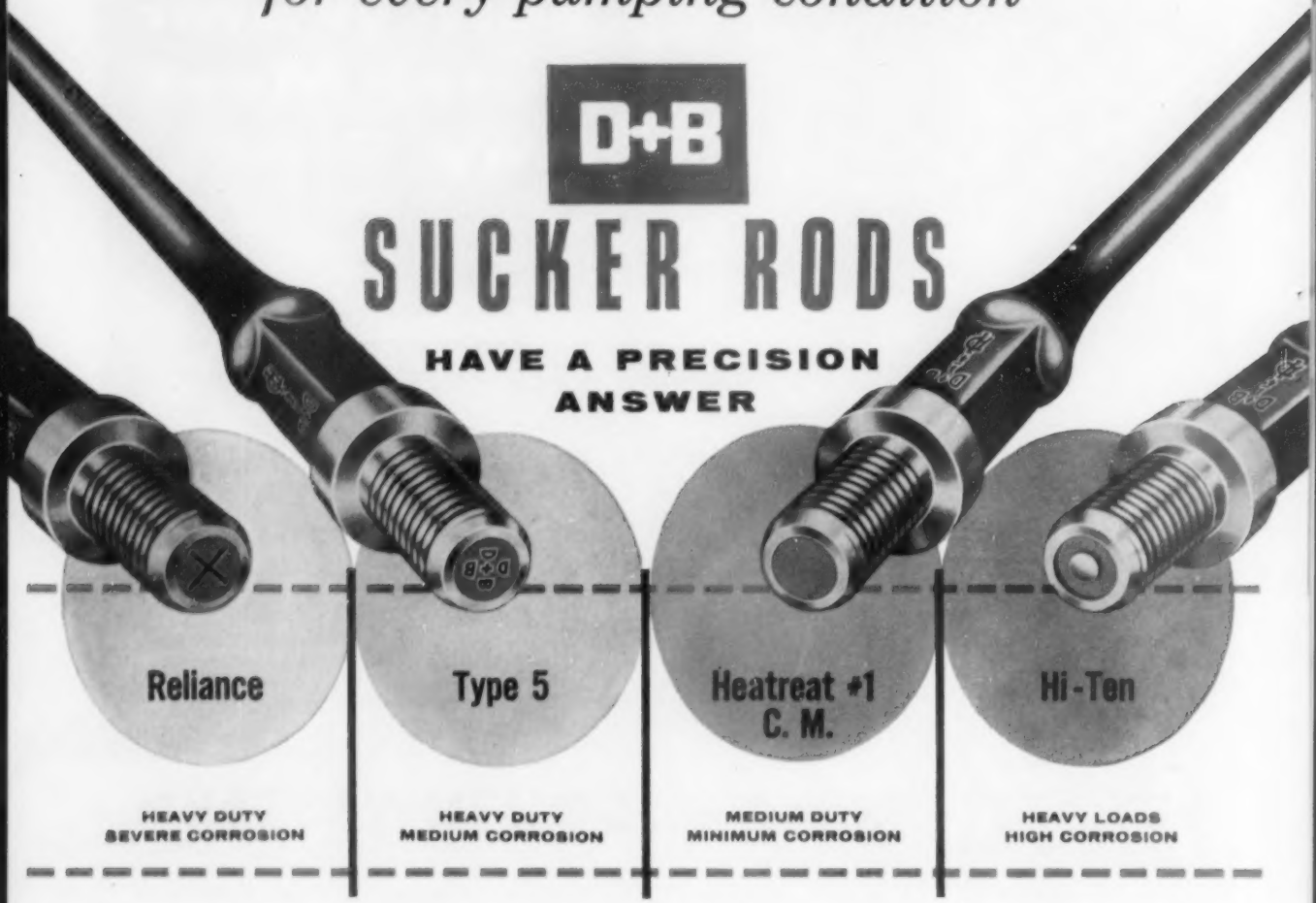
Mail Address_____

Town_____

for every pumping condition

D+B SUCKER RODS

HAVE A PRECISION ANSWER



To give you the right combination of strength, ductility, hardness and impact properties, D+B Sucker Rods are made from metallurgically controlled steel, full length heat-treated under accurate factory conditions. Carefully controlled straightening, forging, full length normalizing and drawing, shot blasting, threading and painting operations assure long, trouble free service in the well. Stop in or call today at your nearest CONTINENTAL or D+B store and select from complete stocks.

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Serving the Oil and Gas Industries

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A Division of The Youngstown Sheet and Tube Company
General Offices: Dallas, Texas
Representatives in all principal oil fields of the world

D+B EMSCO

EMSCO MANUFACTURING COMPANY
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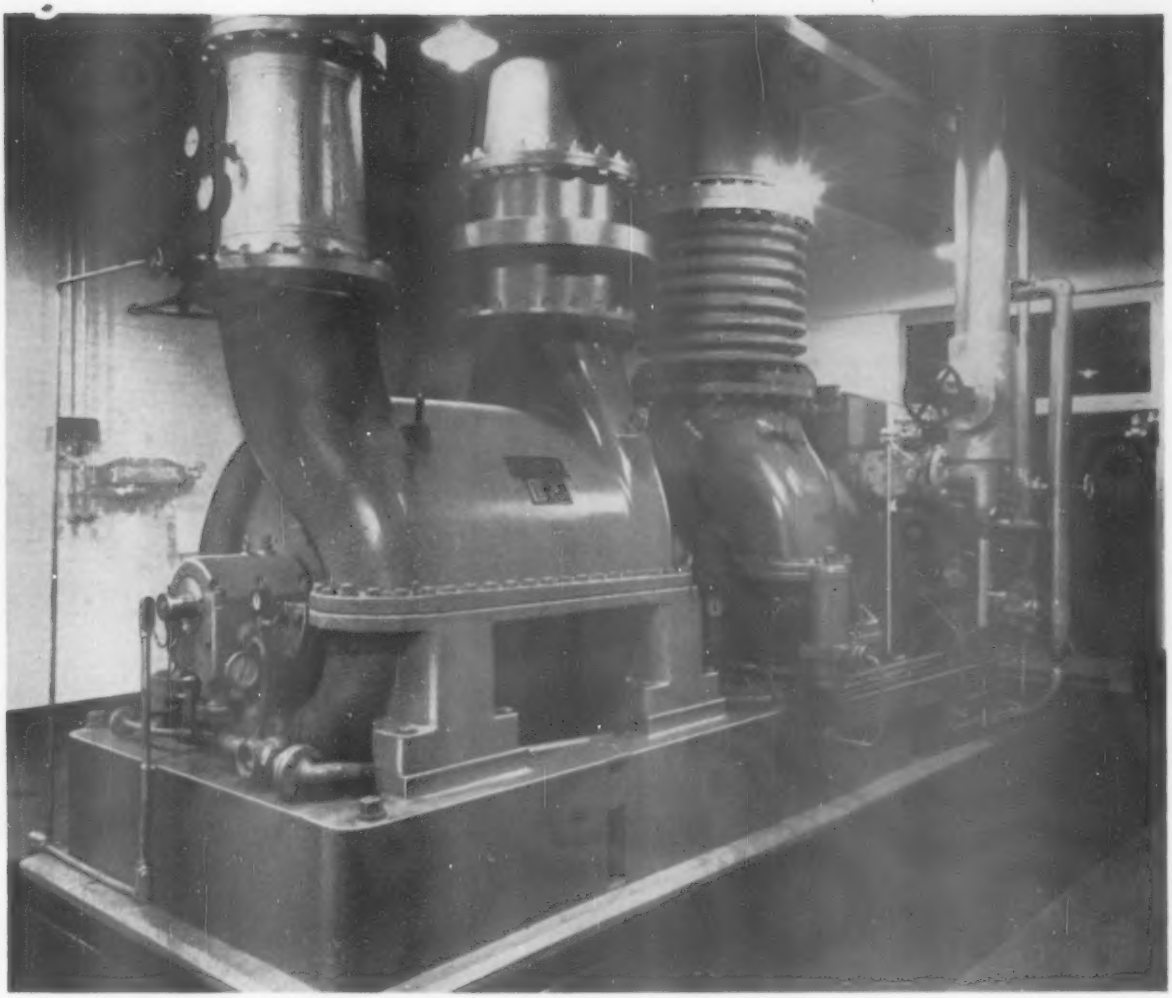
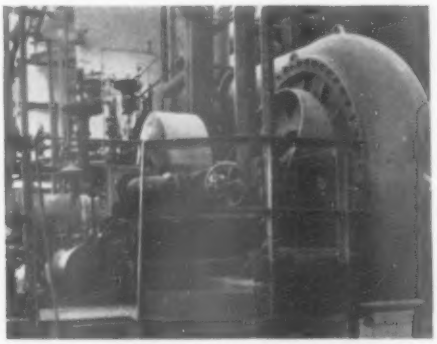
SR—604



Tops for Refinery Service...

ELLIOTT TURBINE-DRIVEN CENTRIFUGAL COMPRESSORS



Another cat cracker gets the benefit of an Elliott turbine-driven centrifugal compressor. Single-stage compressor handles 36,050 inlet cfm at a discharge pressure of 4.0 psig; turbine develops 890 hp at 3600 rpm.

Years of non-stop service lie ahead of Elliott turbine-driven centrifugal compressors like the one shown above which was recently installed in a new cat cracker in the Southwest. The Elliott multistage compressor, handling 19,500 inlet cfm at 22.0 psig discharge pressure, and the Elliott steam turbine, rated 2035 hp at 5800 rpm, have been teamed together by Elliott engineers. Coordinated design, and construction, followed by a combined shop test, have made this a smoothly-operating unit that performs as well as it looks.

Get complete details about Elliott turbine-driven or motor-driven centrifugal compressors; ask your Elliott field engineer or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

P6-2

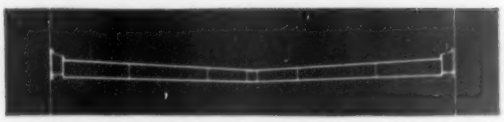
STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

GRAVER® *floating roofs protect against static electricity*

Static electricity, a recognized hazard in petroleum storage, is caused by turbulence during filling and emptying. It builds up in vapor spaces beneath the roof —usually in periods of low inventories. With Graver's Double-Deck Floating Roof design, this danger is greatly reduced.

Graver's design is different. There's no space for air or vapors—often corrosive as well as explosive—to accumulate. Because of the downward pitch of the lower deck, the underside of the roof is always in full contact with the crude or product.

For the very best in floating roof design, call on Graver.



The downward pitch maintains full contact with the liquid.

GRAVER Conservation tankage

- Expansion roof
- Vapor-Mizer
- Double-deck roof ✓
- Center-weighted pontoon roof
- Center-weighted pan roof

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

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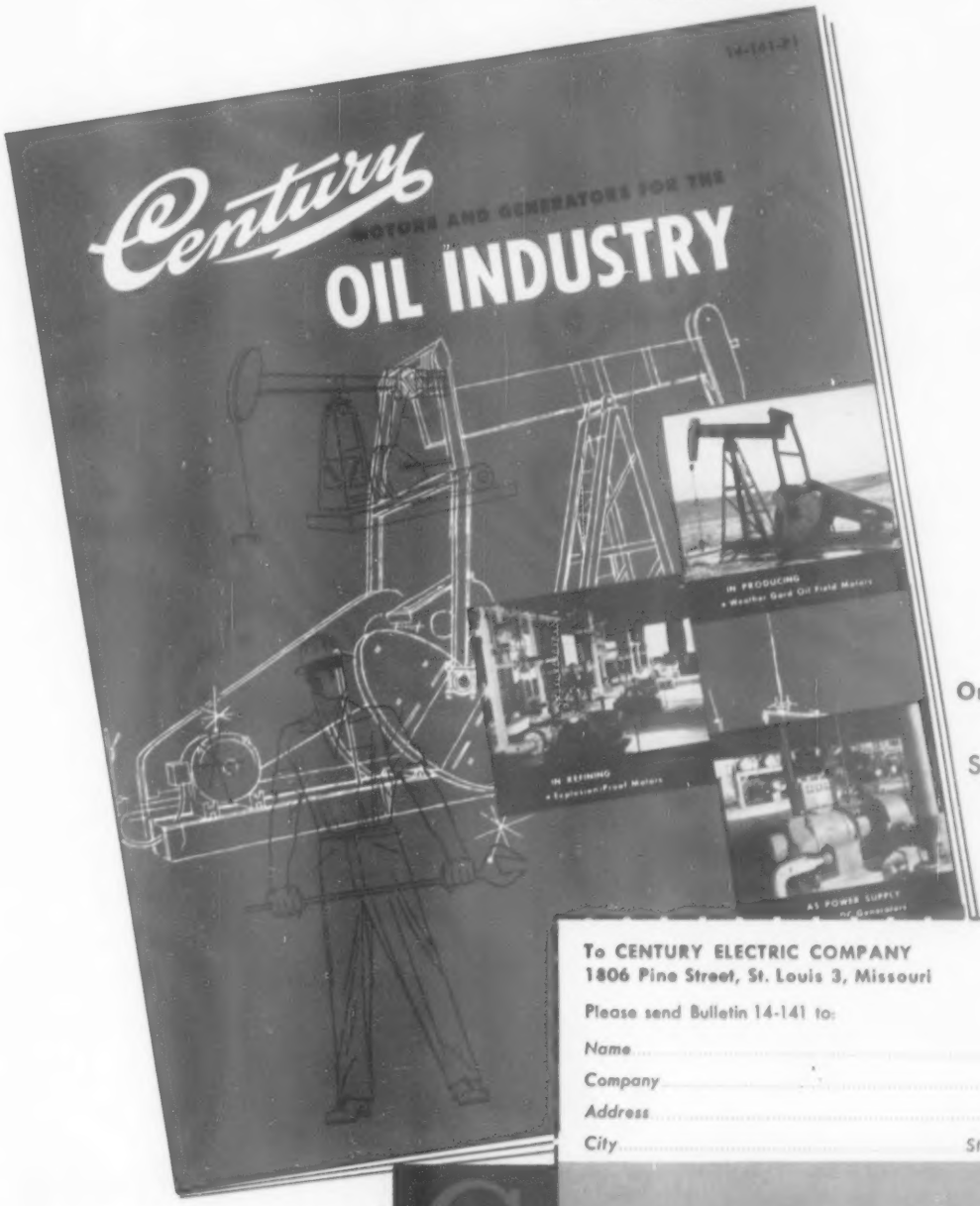
Choose your motors scientifically...
FOR LONGER, SAFER SERVICE!

Read this new Century bulletin written specially for oilmen... in the field and in refineries



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He can't settle for anything less than A PERFECT SEAL

To the deep-sea diver, anything less than a perfect seal would be a mistake

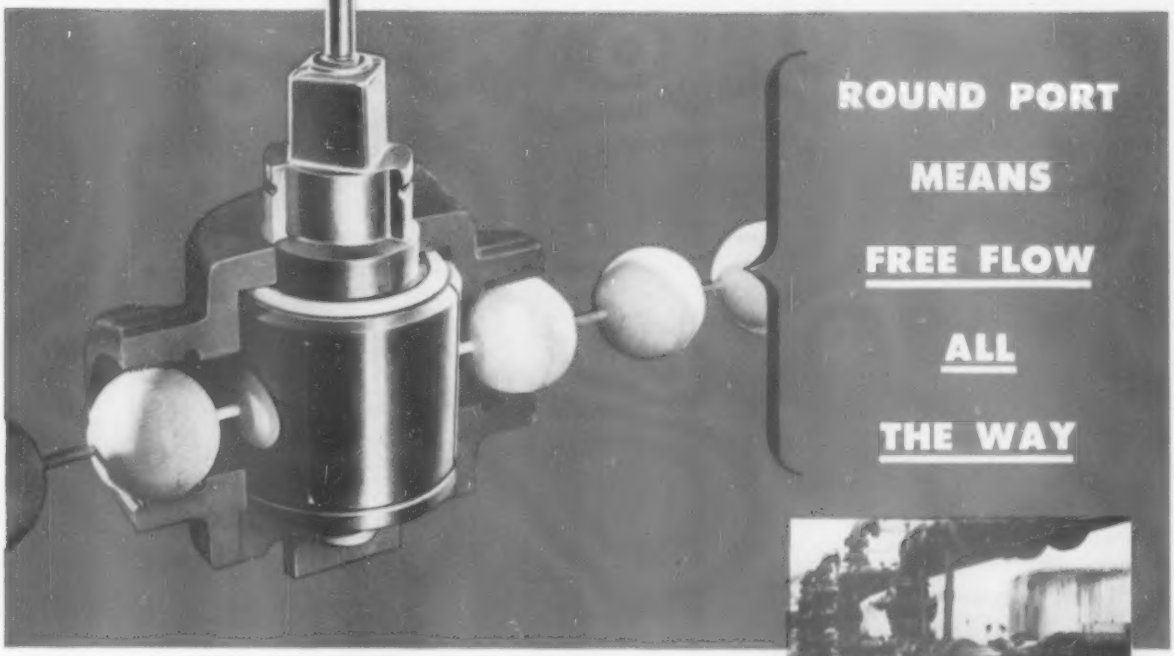
Likewise, the efficiency of your gas and diesel engines is related to the perfection of a seal —the one formed by the piston rings. Don't you settle for less than the seal which is made possible by Pedrick *Formflex* oil rings—the most perfect seal you can get from any piston rings. This is so because of the exclusive Formflex "Equalizer" which provides the utmost in uniformity of pressure, flexibility and conformability. Thus, it meters exactly the right amount of oil to the top rings to assure a perfect seal.

Engineered Sets or open-stock rings, you'll get more efficient performance from top to bottom groove with Pedrick Rings. Pedrick Engineering Service is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, SAratoga 9-3770.

Pedrick
PISTON RINGS

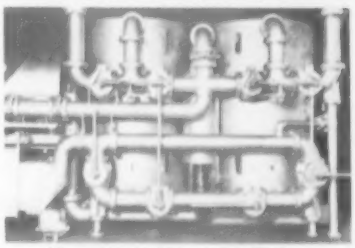
PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

acf Lubricated Plug Valves



ROUND PORT MEANS FREE FLOW ALL THE WAY

In salt water disposal plant.



Absorptive dryer installation.

In natural gasoline plant.

You get full volume, unrestricted flow throughout the entire piping system when you use acf Round Port Valves.

The pipe-matching port openings cause no loss in head pressure—offer no more resistance to flow than the pipe itself. There are no obstructions—no turbulence and no harmful abrasive effects from solids in suspension. Even the most heavy viscous ladings flow freely through acf Round Port Valves.

Split-second quarter-turn shutoff, non-wedging cylindrical plug, Teflon* head gasket, are additional advantages that add to perfect performance of acf Round Port Valves—that mean extra long trouble-free service—lower maintenance costs and fewer work stoppages.

Act now to step up valve performance—to keep maintenance costs down. Representatives in 50 principal cities.

* DUPONT TRADE NAME

W-K-M MANUFACTURING COMPANY, INC.

A SUBSIDIARY OF acf INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

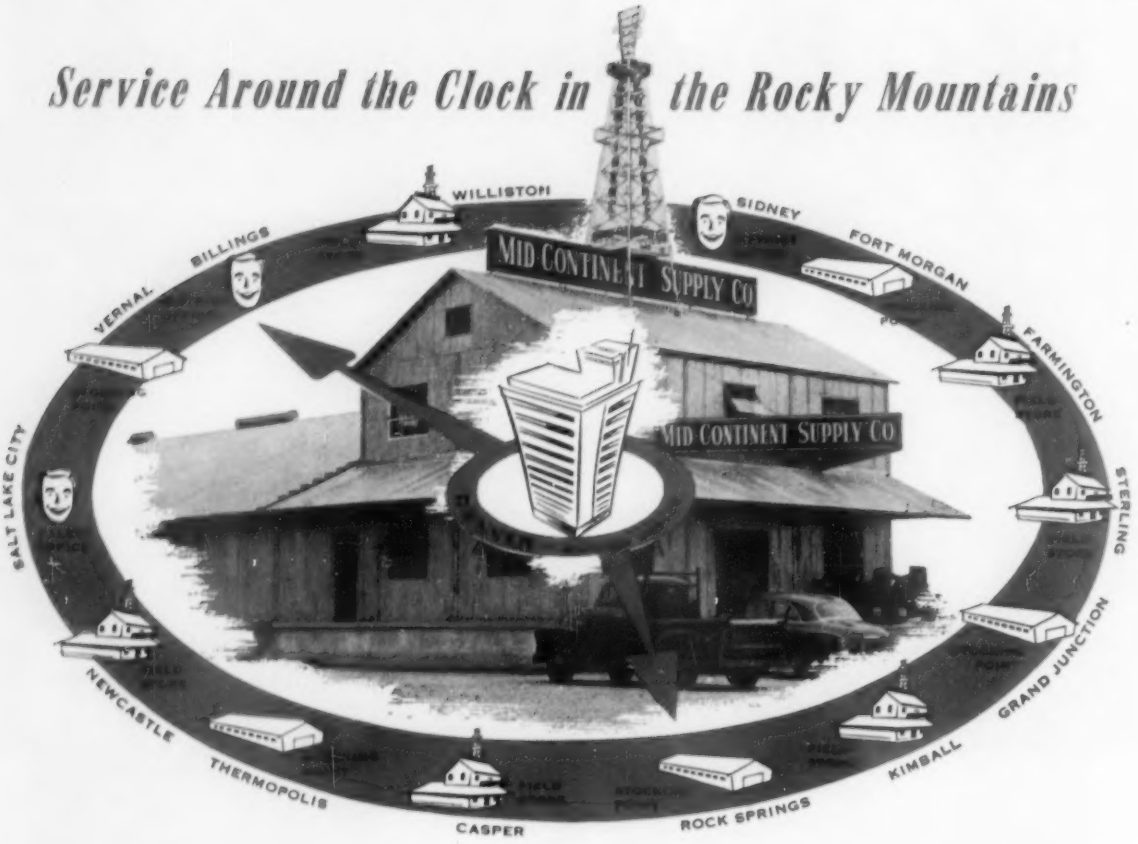
MANUFACTURING

W-K-M THROUGH-CONDUIT GATE VALVES

acf LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS

Service Around the Clock in the Rocky Mountains



How Mid-Continent Supply Company gives service that's fast where distance is vast

To speed service to our customers in the Rocky Mountain area, Mid-Continent maintains stocks of supplies and equipment at strategic Stocking Points in addition to the complete inventories carried in our Field Stores. With both Stores and Stocking Points to draw from, our representatives can offer prompt delivery to almost any location in the area.

Another Mid-Continent facility is mobile two-way radio in a portion of the Rocky Mountain area . . . an important aid in expediting service.

In the Rocky Mountains, and wherever there is oil, call on Mid-Continent for SURE SERVICE . . . SURE SUPPLY.

MID-CONTINENT
Supply Company
MID-CONTINENT BLDG. FORT WORTH, TEXAS

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Mid-Continent Supply Company gives faster service—and improves efficiency—with expanded General Electric two-way radio system

General Electric 2-way radio base station at the Snyder, Texas store handles calls to and from radio-equipped field vehicles in the area. Rig operators want fast action—Mid-Continent cuts time & mileage delays—gives superior service.

DOWN-TIME on an oil rig costs big money. To keep operating, oil men depend on the fast-moving parts and supply services provided by Mid-Continent. In turn, Mid-Continent relies on a recently expanded General Electric two-way radio network to maintain contact with field men working the oil field sites. Supply and service vehicles, equipped with mobile radio, speed customer service by cutting time and mileage delays.

Radio Now Serves Mid-Continent In Five States

Mid-Continent now operates 18 narrow-band G-E transmitters, feeding signals to 89 mobile units in a five-state area. Stores in Texas, Oklahoma, New Mexico, and parts of Colorado and Nebraska are in constant contact with their field men. An emergency repair call relayed to a mobile unit sends a man, or a part, on the way to the job site in a matter of minutes.

New General Electric Progress Line Radio

New Progress Line radios offer complete plug-in chassis design, chassis interchangeability, and they operate on 6 or 12 volt power. Only General Electric mobile radios feature the new 6600 series tubes—manufactured and pre-tested for absolute dependability in 2-way radio circuits. Ask your G-E Communications Counselor for the full details, or, write: *General Electric Company, Communication Equipment, Section X876-9, Electronics Park, Syracuse, New York.* In Canada, write: *C.G.E. Electronics, 830 Lansdowne Avenue, Toronto.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Well-known Newscaster,
WJBK-TV, Detroit

Jac LeGoff asks
Students and College Presidents:

"SHOULD BUSINESS GIVE MONEY TO HELP COLLEGES AND STUDENTS?"

GEORGE L. HOUGHTON, graduate student (shown above in chemical laboratory), University of Michigan:
"Because advanced study requires extra years of financial outlay, many capable students are placed under a big handicap. Some companies with an intelligent interest in our national welfare have established fellowships to encourage these students to continue. If there ever was conservation of 'natural resources', this is it."

DR. RUSSELL J. HUMBERT, President of DePauw University, Greencastle, Indiana:
"We can be thankful that business *is* giving financial aid to colleges. If outside financial aid were not available, many small colleges would have to raise tuition fees to a point which some students could not afford. Inevitably, some fine boys would miss out on higher education, to their own loss and that of our country."

MARCELLA KRAKOWSKI, Beloit College, Beloit, Wisconsin:
"Well, let's put it this way. The smaller liberal arts colleges and many of their students need a helping hand with their financial problems. Some progressive companies—recognizing this need—are making a real contribution in this respect. Yes, money from business sources gives us necessary encouragement and support."

DR. MILLARD G. ROBERTS, President of Parsons College, Fairfield, Iowa:
"Far-sighted businessmen who understand the close relationship between sound education and the over-all national welfare already have answered that question with generous financial aid. They are not only helping many young people to develop their full potentialities, but they are also helping to build a stronger, better-informed America."

What Makes A Business A Good Citizen?

At Standard Oil we believe that a business concerned with good citizenship should take a constructive interest in matters affecting our national welfare. To give financial aid to colleges and students is the American way to help build our country's future. Standard Oil has provided the means to support scholarships and graduate fellowships in science for college students and to aid privately-financed liberal arts colleges in 14 Midwestern and Rocky Mountain States.

STANDARD OIL COMPANY (INDIANA) STANDARD

GULF REFINING COMPANY BAYOU COUBA FIELD COMPRESSOR STATION—equipped with a Beaird-Ingersoll-Rand 165 h.p. 6 JVG four cycle gas engine driven compressor. Young radiator with lubricating oil cooler and gas coolers, and all necessary controls for unattended operation. Other sizes 110 to 660 h.p.

Packaged Compressor for —

BARGE MOUNTED GAS LIFT SERVICE

Gulf Refining Company has installed this barge mounted compressor station in Bayou Couba Field, Louisiana. Part of a 21-well gas lift operation, the 165 h.p. 6 JVG Beaird-Ingersoll-Rand packaged unit was added to supplement three high gas-oil ratio wells formerly used to produce the field. Picking up from the lifted wells at 50 psig., the compressor boosts the gas into the injection system at 825 psig. where it is joined with make-up gas drawn from the high ratio wells. By using a closed gas lift system Gulf has stopped flare gas losses and extended the life of the high gas-oil ratio wells.

Completely packaged and on its own skid base, the unit was installed on a conventional cargo barge. Piping and plant layout has been designed to facilitate the economical addition of a second compressor to the station when required.

Fully automatic in operation, the compressor is equipped with speed and pressure regulators which permit it to swing with changes in line pressure by varying the engine speed through a range of 50% to 100%. Other controls watch over the unit day and night ready to shut it down should any unusual operating condition occur. Only routine scheduled inspection and maintenance is required for 24-hour unattended operation.

Let us tell you about the economy of using Beaird-Ingersoll-Rand packaged compressor plants for offshore and tidelands production.

MACHINING
MANUFACTURING
STEEL WAREHOUSE

BEAIRD

THE J. B. BEAIRD COMPANY, INC.

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

SHREVEPORT, LOUISIANA • Sales Offices: *Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado • Los Angeles, California, and Cie. Ingersoll-Rand, Paris, France*

Double-Barreled SAVINGS...

when you use

MARTIN PLUNGERS

1 SAVE ON PLUNGER COSTS

One Martin Plunger will make many long runs, with only the rings being replaced. A set of rings costs only one fourth as much as a new plunger. Thus it is easy to figure the savings on the plunger alone.

2 SAVE ON BARREL COSTS

Metal to metal wear is eliminated. The resilient rubber & duck rings are so much easier on the barrel surface that barrels usually last several times longer. Here too is an important item in pump costs.

MORE BARRELS IN THE TANK TOO because of better seal, freer travel in the barrel and longer runs. AVAILABLE for your pump and your well, regardless of diameter, or depth or well condition. Get catalog No. 4 and read how to make selection and installation.

MARTIN PLUNGERS ARE SOLD THRU SUPPLY COMPANIES

JOHN N. MARTIN

Manufacturer

9 W. BRADY • TULSA, OKLA.

Goes places a standard station wagon can't... carries up to 50% more payload!

Take a good look at the new Dodge *Town Wagon*—the ideal low-cost vehicle for your business! It's a double-duty carrier of passengers, cargo, or *both*. And with Forward Look styling it's as handsome as it is versatile!

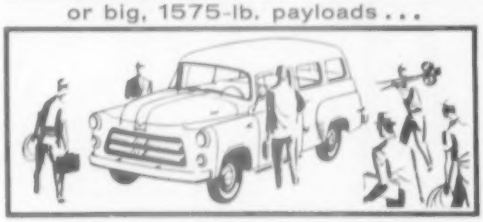
The *Town Wagon* is built on a rugged ½-ton Dodge *truck* chassis, giving you extra ground clearance for off-the-road driving. It's powered by either the famous Dodge L-head Six or the new Power-Dome V-8.

With seats in place, one model carries six passengers, the other eight. In the six-passenger model you've got about 90 cubic feet of load space in the rear compartment. The same amount of space is available in the eight-passenger model with the rear seat removed. You can also take all extra-passenger seats *out* of either model, leaving clear, unobstructed room for a big, truck-size payload of 1575 pounds.

You can see . . . and *drive* . . . the *Town Wagon* at your Dodge dealer's now.

Carry 6-8 passengers . . .

or big, 1575-lb. payloads . . .



or passengers plus cargo

DODGE TOWN WAGON

WITH THE *FORWARD* LOOK

MAIL TODAY!

Advertising Department E—Dodge Division
Chrysler Corporation
P.O. Box 1259—Detroit 31, Mich.

Please send me more information and complete specifications for the new Dodge *Town Wagon*.

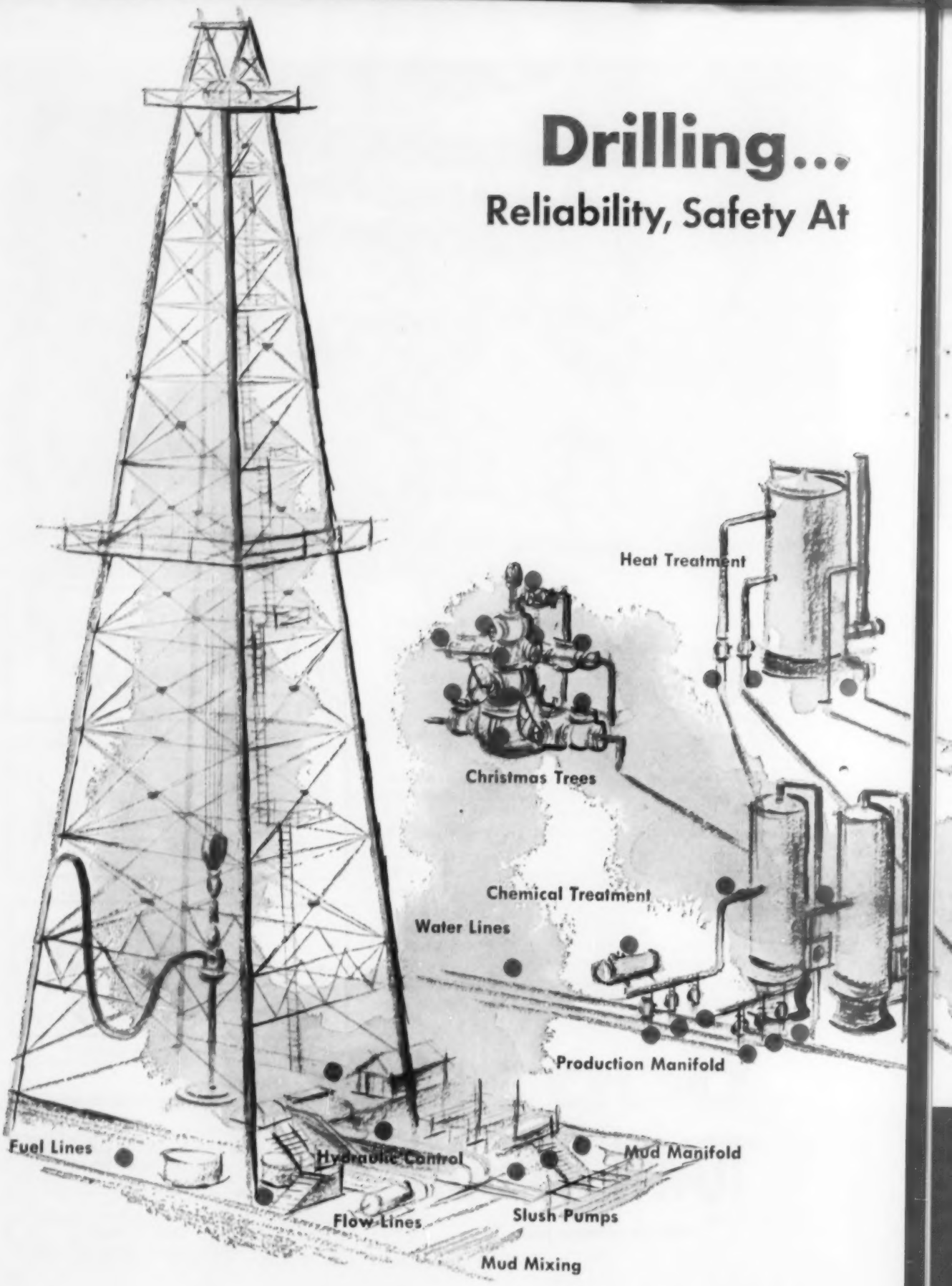
Name_____

Street address_____

City_____ Zone____ State____

Drilling...

Reliability, Safety At



Completion...Production

Every Step With ROCKWELL-Nordstrom VALVES

Field men depend on Rockwell-Nordstrom valves for reliable, safe flow control. They know that Rockwell-Nordstrom exclusive Sealdport* lubrication assures leakproof, positive shut-off and instant, quarter-turn operation that can't be had in ordinary valves.

The dependability of Rockwell-Nordstrom valves has been proved by forty years of service throughout the oil and gas industries. They can't be matched from any standpoint, yet they cost no more to buy, often less than ordinary valves. For more information, call your supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

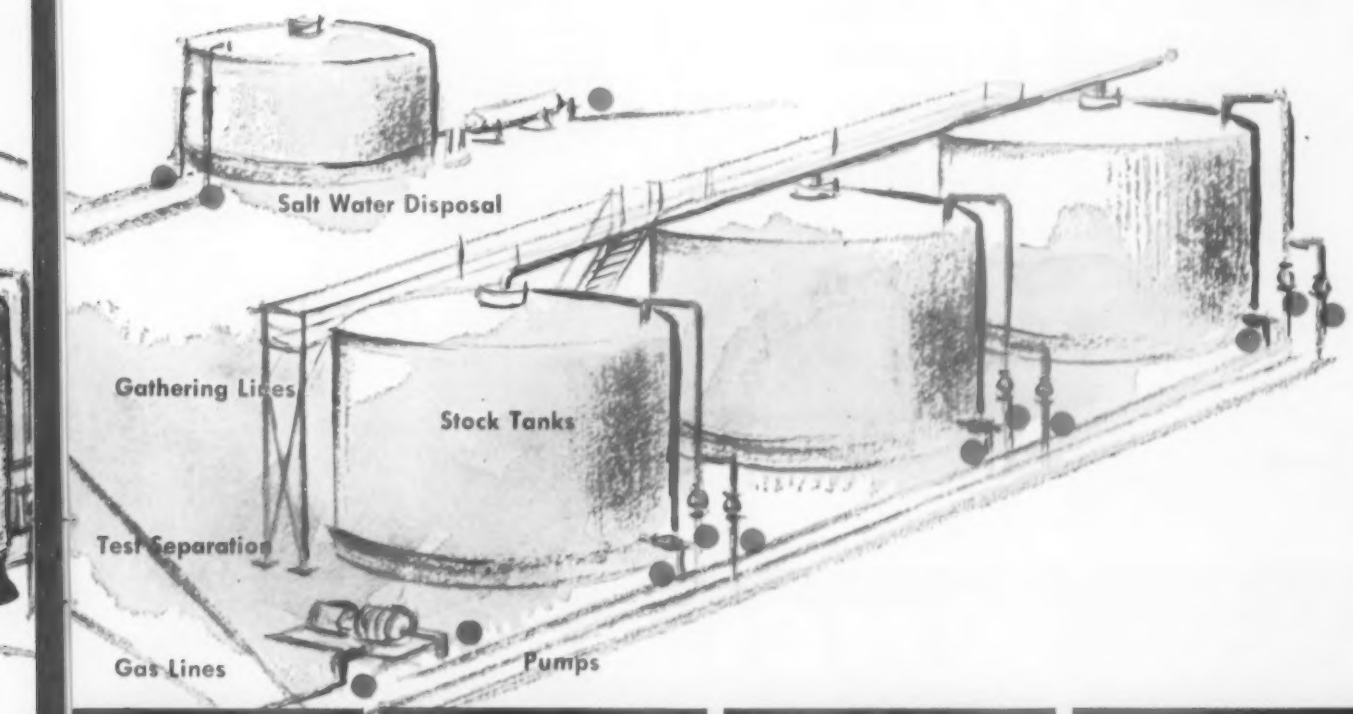
Canadian Valve Licensee: Peacock Brothers Limited.

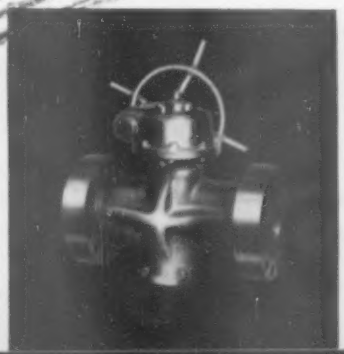
*Registered trademark Rockwell Manufacturing Company

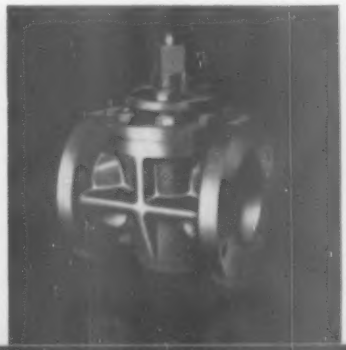
ROCKWELL-Nordstrom VALVES

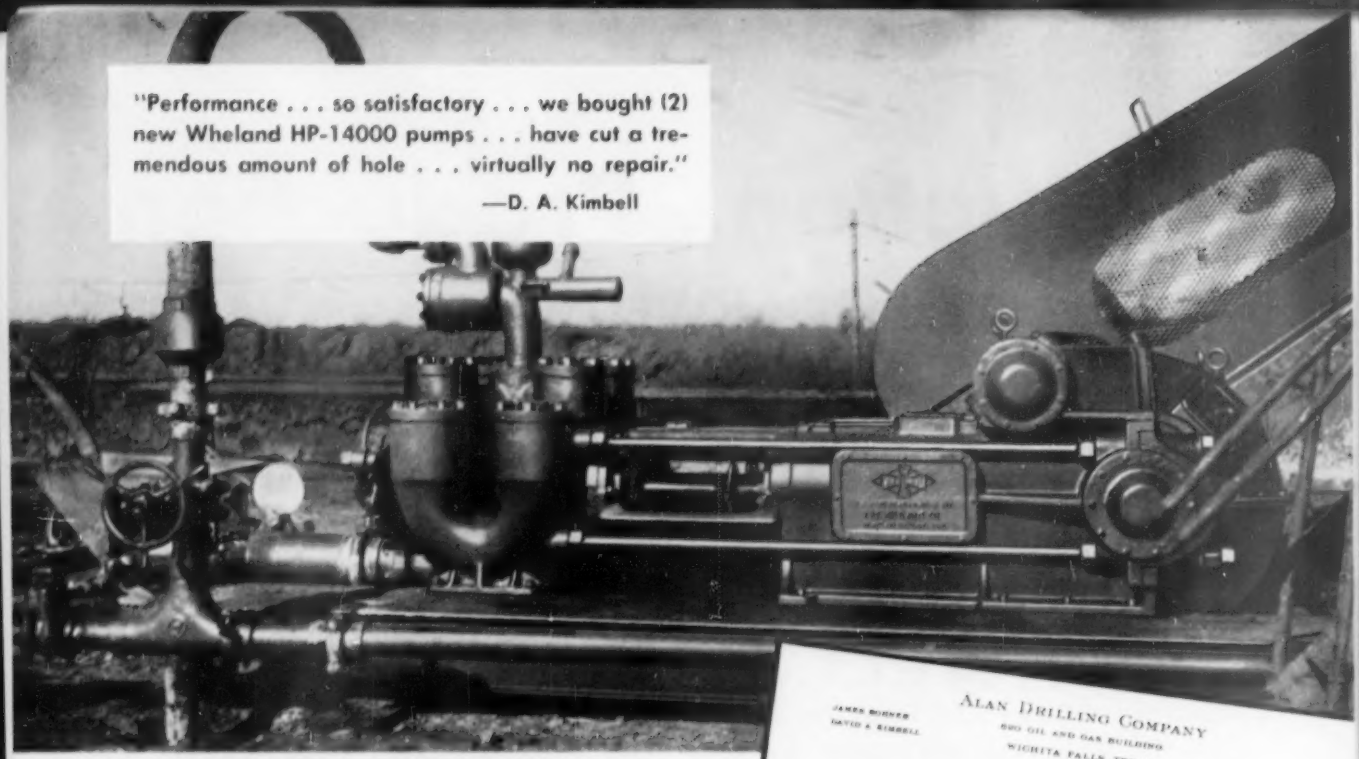
Lubricant Sealed for Positive Shut-Off

40th YEAR *of lubricated plug valve leadership*









"Performance . . . so satisfactory . . . we bought (2) new Wheland HP-14000 pumps . . . have cut a tremendous amount of hole . . . virtually no repair."

—D. A. Kimbell

One of the field proven Wheland HP-14000 pumps operated by the Alan Drilling Co.

OUTSTANDING PERFORMANCE!
DEPENDABLE OPERATION!
LOWER MAINTENANCE!

WHELAND HP-14000

7-1/2"x14" DUPLEX SLUSH PUMP

350 Horsepower Nominal Input at 60 RPM

Discharge pressure with 7½" liners 838 PSI

Discharge pressure with 5½" liners 1627 PSI

Built for fast, steady operation!
Delivers more pressure per pound of pump!

write for detailed bulletin

ALAN DRILLING COMPANY

JAMES BURNER
DAVID A. KIMBELL

800 OIL AND GAS BUILDING
WICHITA FALLS, TEXAS

March 8, 1956

Mr. Gordon P. Street, President
The Wheland Company
Chattanooga, Tennessee

Dear Mr. Street:

We commenced operations as a drilling company in 1952 with the purchase of a second-hand rig which included an old-style Wheland HP-11000 pump.

This ancient pump's performance was so satisfactory that when we began acquiring new machinery, one of the first items we bought was the new Wheland HP-14000 pump. This was followed about a year later with the purchase of another new HP-14000 Wheland pump. These two new pumps have cut a tremendous amount of hole in Jack, Young, Throckmorton, Grayson and Cooke Counties, Texas, with virtually no repair expense. Incidentally, the old Wheland HP-11000 is still running nearly every day as a standby on our largest rig.

We now operate three rigs in North Texas and Southern Arkansas, and of the four pumps involved, three are the Whelands referred to above. We drill contracts, interest deals, and for our own account, from 2000–9000 feet.

Youre very truly,

ALAN DRILLING COMPANY

D. A. Kimbell

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND COMPANY

CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS

DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC.—Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas • JONES AND LAUGHLIN STEEL CORPORATION, SUPPLY DIVISION—Main Office: Drawer 2481, Tulsa 2, Oklahoma.

EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

THE BEST WAY TO LOWER

OPERATING COSTS.... LOWER A REDA PUMP INTO YOUR WELL

With investment and labor costs continuing to increase, economy of operation is of paramount importance in producing wells with decreasing oil-water ratios.

Reda-Submergible Pumps are an economical means of producing wells with high fluid volume. Over 80 million barrels of oil have been produced to date from wells previously unprofitable to operate. Not only has production increased, but pumping with Reda extended the ultimate economic life of thousands of wells previously produced at low rates of fluid withdrawal.

Sizes are available to 300 h.p.; capacities from 20 bbls. to 25,000 bbls. per day; depths from 200-feet to over 10,000-feet. Easier, less expensive installation, low operating costs, increased production, greater operating life, and efficient performance lower costs when pumping with Reda.

Write today for further information. Reda engineers will be pleased to furnish complete information.

SIGN OF QUALITY . . . SUBMERGIBLE REDA PUMPS

REDA

PUMP COMPANY

BARTLESVILLE, OKLAHOMA

They Say—

Keotane Explained . . . Somewhat

Dear Sir:

Since the announcement of Skelly Oil Co.'s new Skelly supreme gasoline with keotane, we have had many inquiries regarding the origin of the formulation.

We thought it might be of interest to you to know that the chemical itself, as well as its application to motor fuel, and allied petroleum refined products, was developed in Skelly Oil Co.'s research laboratories at Pawhuska. The research laboratories are under the direction of the manufacturing department, myself, vice president, with Tulsa office supervision being directly under Howard H. Belew—laboratory supervision under J. F. Wood.

Keotane was not in commercial production prior to the middle of 1955 and, as far as we know, was a laboratory curiosity prior to that time. The research laboratory of the manufacturing department of Skelly Oil Co. pioneered the development of the chemical and its application in motor fuel.

James W. Vaiden
Vice President in charge of manufacturing
Skelly Oil Co.
Tulsa, Okla.

Stature for the Industry

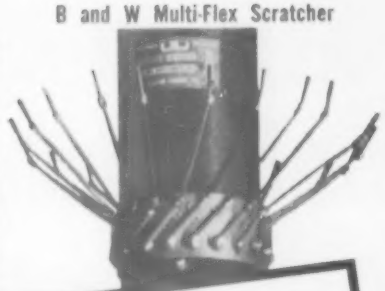
"The petroleum industry must have taken exceptional pride . . . in the performance of two of its members before the special Senate committee to investigate political activities, lobbying and campaign contributions.

"Those two men are Leonard F. McCollum, president of Continental Oil Co., and Paul Kayser, president of El Paso Natural Gas Co. Their testimony on the activities of the Natural Gas and Oil Reserves Committee was frank, refreshing, and revealing. They held back nothing and they gained considerable stature for an industry which can use some stature outside of its own producing area . . .

"The question was whether or not the NGORC had engaged in any form of lobbying or other political activities . . . The answer was clear. It did none. What NGORC did do was to tell the story of the natural gas producer to the public with a concentration of effort in geographical areas of doubt and ignorance. In most of those areas it was replying to misinformation and misrepresentation put out by opponents of the Harris-Fulbright bill . . .

"These gentlemen earned not only

B and W Multi-Flex Scratcher



B and W Inc.
For a good cement job

B and W
Latch-On Centralizer

Also: B and W Multi-Flex Scratcher • Hinged Nu-Coil Scratcher • Rotating Scratcher, Multi-Flex type • Rotating Scratcher, Nu-Coil type • Latch-On Centralizer with Ken-Kave Bow • Latch-On Stabilizer • Stabilock

B and W Inc.
Well Completion Specialists

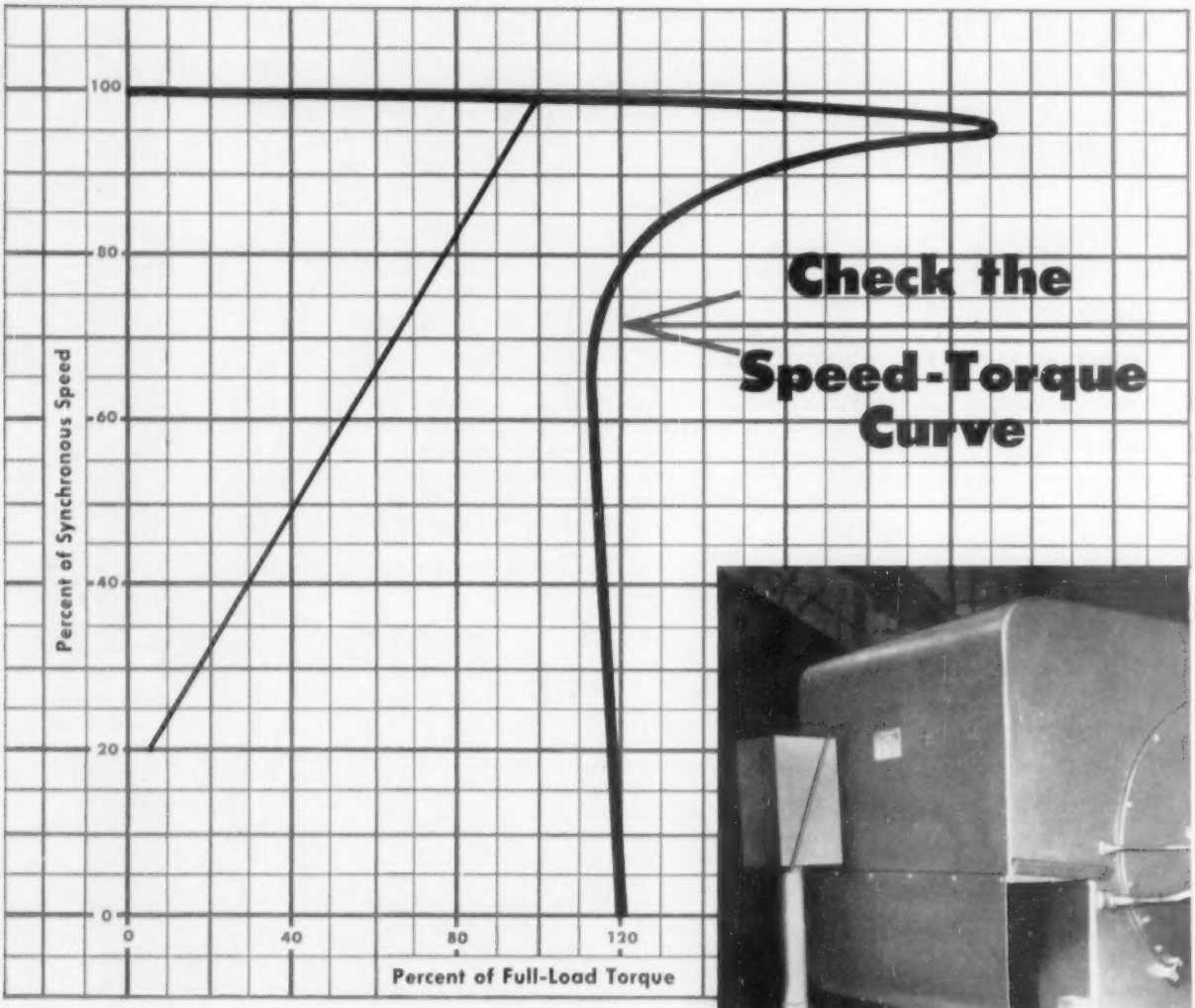
GULF COAST
Box 5266
Houston 12, Texas
Phone WA 3-6609

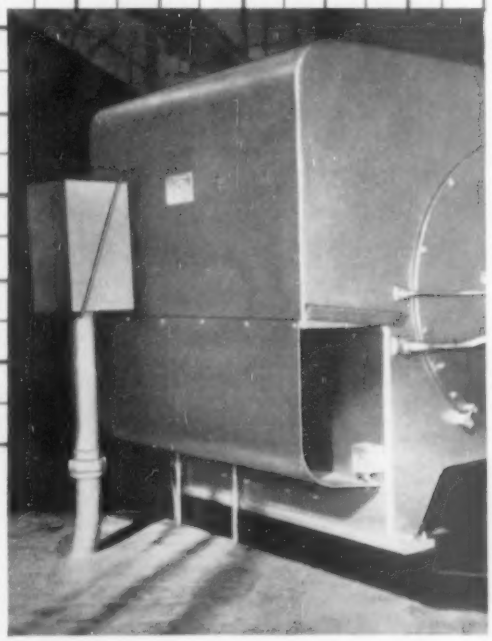
WEST COAST
Box 3751, Terminal Annex
Los Angeles 54, California
Phone DA 4-1106

6352

ALLIS-CHALMERS Pipeline Motors

Restart Automatically





This curve shows the speed with which an Allis-Chalmers pipeline motor reached full load-carrying capability. Plotted over it is average pump curve which shows that there is no point at which overload could cause the motor to shut off. Illustrated is an Allis-Chalmers weather-protected pipeline motor, rated at 1250 hp, 3580 rpm, now operating in a pipeline station.

A-C ALLIS-CHALMERS

A-5129

ALLIS-

After Power Interruption

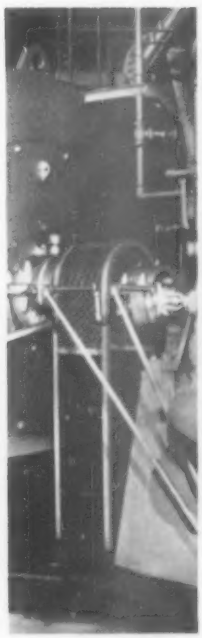
Check the Speed-Torque Curve on the Allis-Chalmers Weather-Protected Pipeline Motor . . ."Water Hammer" Won't Keep this Motor from Starting Again in Remote-Station Operation

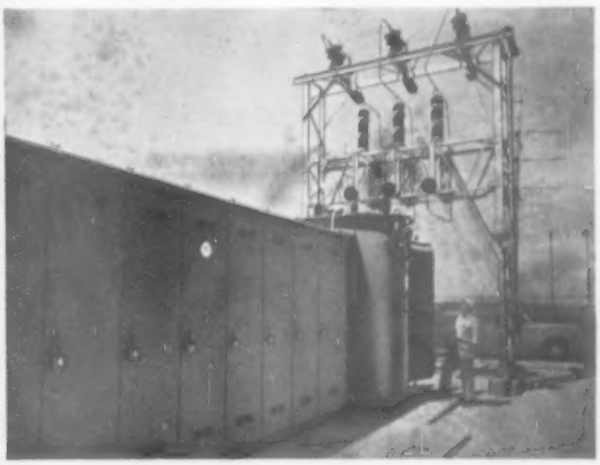
THE power supply fails, and the pipeline pumping station is out of business. When power comes back on, ordinary motors just won't start automatically.

Allis-Chalmers pipeline motors are the answer to this operating problem. The "water hammer" action in the pipeline won't keep these special Allis-Chalmers motors from starting . . . even though an attendant is there or not.

These motors, for remote or attended pipeline duty, are built by Allis-Chalmers for high efficiency operation and good speed-torque characteristic. They are designed to do the job, and they will start again immediately . . . automatically. Allis-Chalmers motors result in more dependable, economical pipeline operation with nothing more than periodic maintenance checks.

For Complete Information, contact your local A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.





This Allis-Chalmers engineered substation furnishes power and control for a remote-controlled midwestern pumping station. Transformer is a 3750-kva, oil-filled type. Switchgear furnished is Allis-Chalmers factory-assembled 1200-amp, 4160 rated volt, outdoor metal-clad type.

LIVE BETTER ELECTRICALLY

CHALMERS

ALLIS-CHALMERS "Coordineered" Pipeline Equipment for Better Operation, Reduced Maintenance

Profitable remote pipeline operation is more than a matter of good equipment. It embraces over-all coordination of factors, including motors, with the right design characteristics; control, such as switchgear, substation equipment; plus utility power conditions, and close cooperation with utility power salesmen.

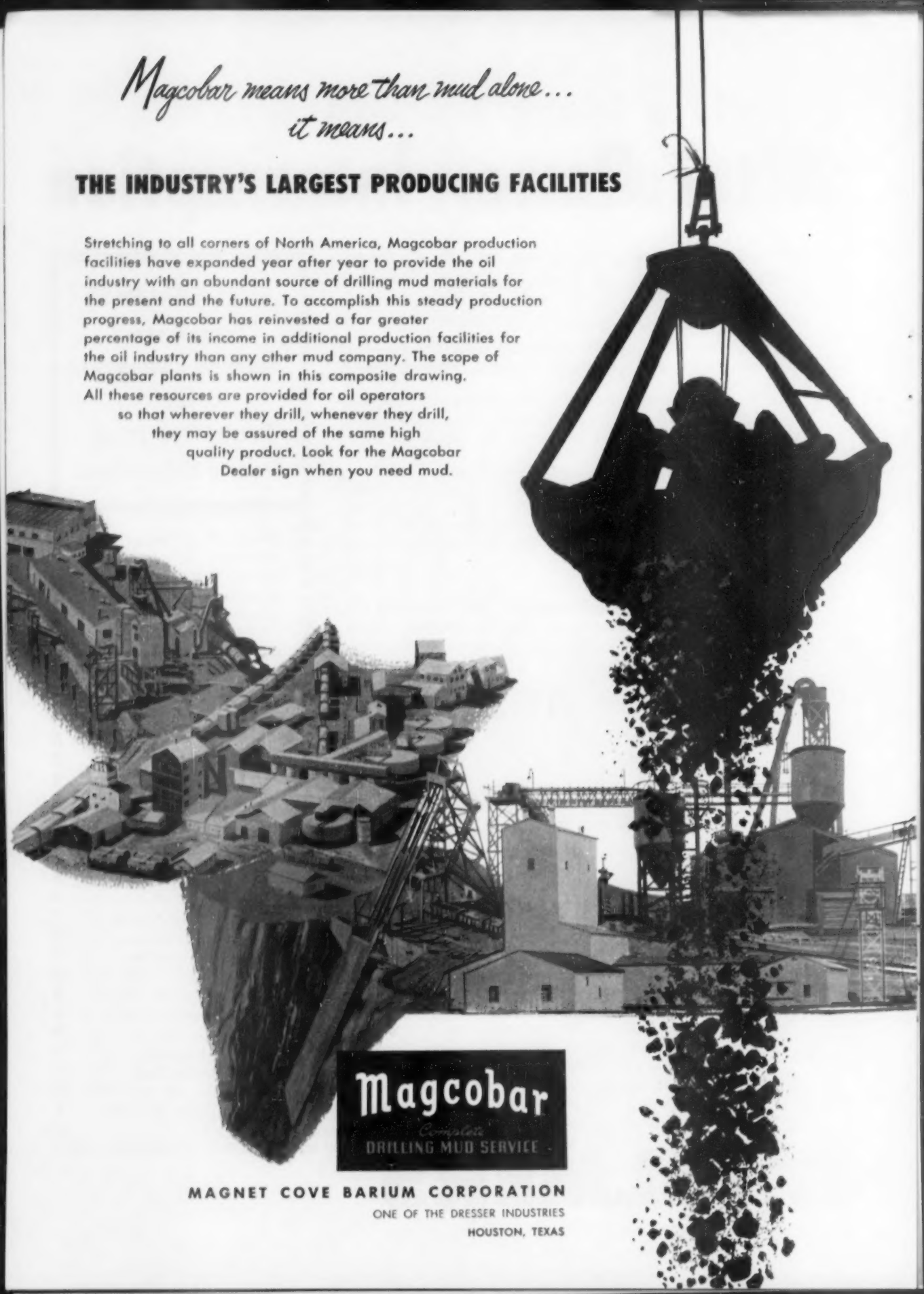
Allis-Chalmers, as a manufacturer of a greatly diversified line of equipment, is in the unique position of being able to provide this practical approach to pipeline power, motor and control problems — the *coordineering* of complete electrical systems.

To get the most for your equipment dollar, call your A-C representative. His recommendations are backed by Allis-Chalmers engineering departments, by experience in many pipeline installations . . . by complete manufacturing facilities.

Magcobar means more than mud alone...
it means...

THE INDUSTRY'S LARGEST PRODUCING FACILITIES

Stretching to all corners of North America, Magcobar production facilities have expanded year after year to provide the oil industry with an abundant source of drilling mud materials for the present and the future. To accomplish this steady production progress, Magcobar has reinvested a far greater percentage of its income in additional production facilities for the oil industry than any other mud company. The scope of Magcobar plants is shown in this composite drawing. All these resources are provided for oil operators so that wherever they drill, whenever they drill, they may be assured of the same high quality product. Look for the Magcobar Dealer sign when you need mud.



Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION
ONE OF THE DRESSER INDUSTRIES
HOUSTON, TEXAS

the profound appreciation of the industry they serve, but of the people who live in the part of the country that the petroleum industry makes prosperous. They also did a magnificent job for their customers, the consumers and all of the people of this country."

Editorial in the Houston Post.

Author Corrects Formula

Dear Sir:

We find an error in the article "Operate Your Cat Cracker for Maximum Yield of Catalytic Naphtha," appearing on page 81 of the June 4 issue. The error is in the "Per cent CO" formula at the top of page 83. This formula should read:

$$\text{Per cent CO} = \frac{100 - 4.784\ (\%\ O_2 \text{ in flue gas})}{4.784\ (CO_2/CO) + 2.892 + \dfrac{11.28\ (\%\ H_2 \text{ in coke})}{\%\ \text{carbon in coke}}\ [(CO_2/CO) + 1]}$$

$$\text{Per cent } CO_2 = (CO_2/CO)\ (\%\ CO)$$

In checking through our drafts of the article we find that the errors in this formula were primarily in the draft we submitted for publication.

R. C. Davidson
Filtrol Corp.
Los Angeles, Calif.

Let the Importers Comply

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Robert L. Wood, president of the Independent Petroleum Association of

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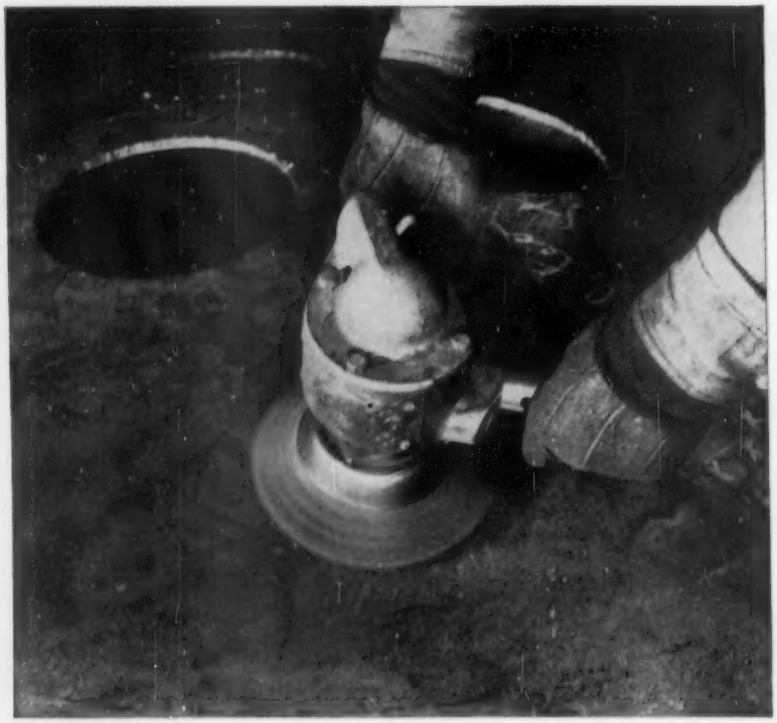

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America, in "The Independent Petroleum Monthly."

Crude Price Increase Not Justified?

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"Economists of our company (Standard Oil Co. of California) disagree with a number of recent forecasts of a general slackening in business activity during 1956 . . . They look for a moderately better business year than in 1955, from the over-all viewpoint . . . anticipate that business activity will remain about level until fall, followed then by generally rising output."

T. S. Petersen, president of Standard Oil Co. of California, at a press luncheon in New York.

CALENDAR OF EVENTS

JULY

17-27 Program on Recent Advances in Catalytic Polymerization, Massachusetts Institute of Technology, Cambridge, Mass.

18-20 Yellowstone-Bighorn Research Association, third Professional Short Course on Uranium Occurrence and Structural Geology, Red Lodge, Mont.

AUGUST

2-4 Rocky Mountain Mineral Law Foundation, Second Annual Institute, University of Colorado, Boulder.

20-21 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

27-29 Sixteenth Annual Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

SEPTEMBER

5-7 Wyoming Geological Association, eleventh annual field conference, Jackson Lake Lodge, Moran, Wyo.

9-12 Independent Natural Gas Association of America, annual membership meeting, St. Anthony Hotel, San Antonio, Tex.

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

12-14 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

16-18 New Mexico Petroleum Industries Committee, annual convention, Hilton Hotel, Albuquerque.

16-21 American Chemical Society, 130th annual meeting, Atlantic City, N. J.

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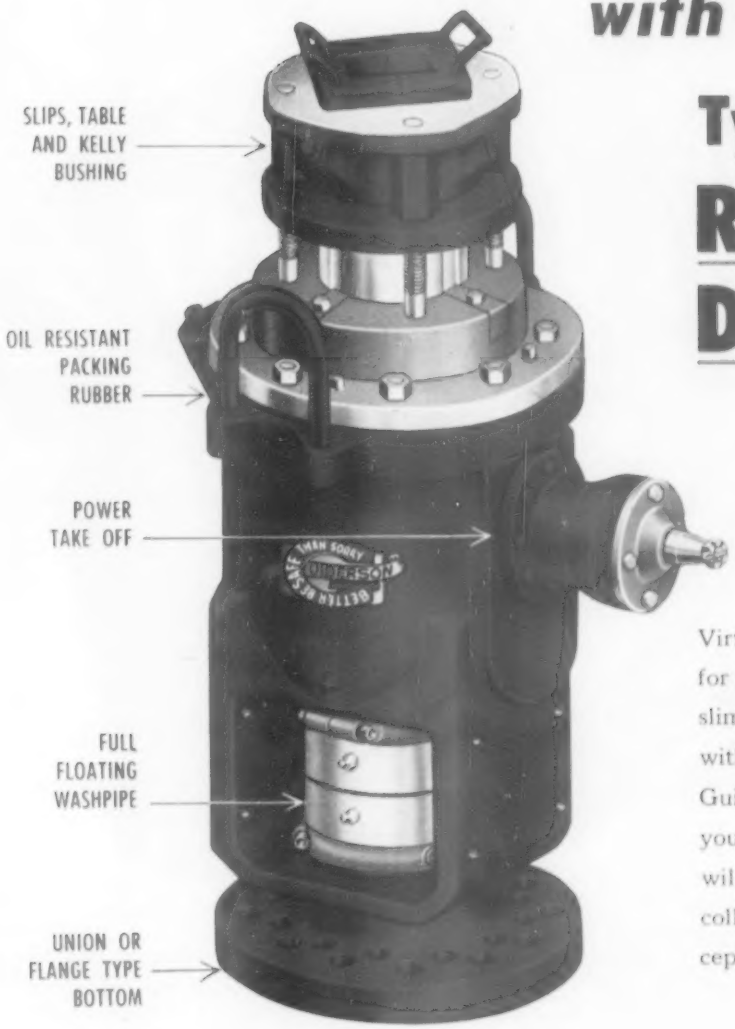
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For over 20 years, more copper ore in the United States has been mined with Texaco-lubricated equipment than with any other.

The Texas Company

TEXACO

16-21 American Society for Testing Materials, Second Pacific Area National Meeting, Statler Hotel, Los Angeles.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

OCTOBER

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

2-4 National Association of Corrosion Engineers, south central region, Beaumont.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Hintington Hotel, Pasadena, Calif.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

14-20 OIL PROGRESS WEEK.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-30 Illinois Geological Survey, Petroleum Engineering Conference on Waterflooding, University of Illinois, Urbana, Ill.

29-Nov. 1 Society of Exploration Geophysicists, annual meeting, Roosevelt Hotel, New Orleans.

NOVEMBER

7-8 Philadelphia section, Instrument Society of America, Symposium on Process Data Logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

12-15 American Petroleum Institute, annual convention, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

JANUARY (1957)

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

"...thinks he's the core catcher."

There's no catching up with the demand for oil. That's the reason Lone Star Steel Company crews work day and night . . turning out API casing, tubing and line pipe for our friends in the oil business in the busy Mid-Continent area.

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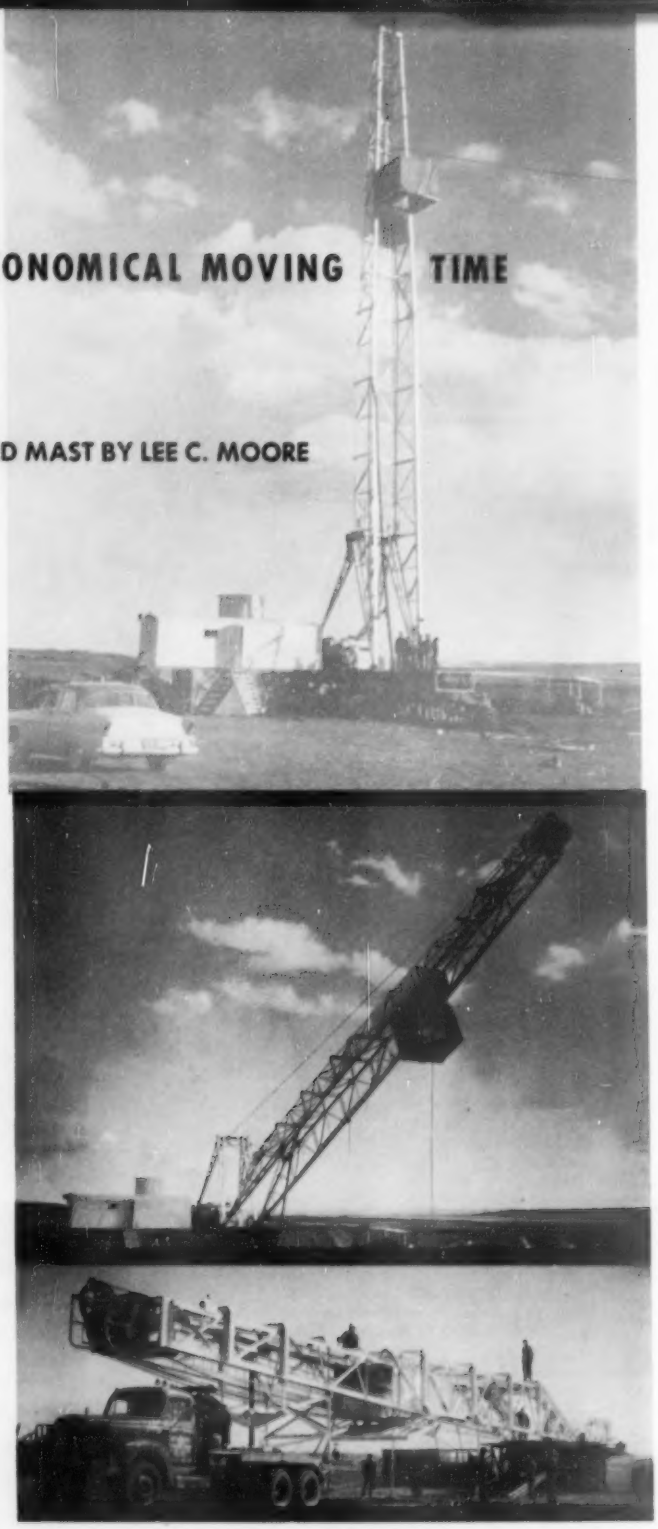

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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone Diamond 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY SPEAKING . . .

"Twenty-Four Barrels"

"Twenty-four barrels of oil a day,
Twenty-four barrels, and that ain't hay.
I look out my window and what do I see?
*An oil well pumping more money for me."**

. . . So runs the chorus of a popular song with which disk jockeys are currently filling the airwaves in all parts of the country. It sounds like something whipped up overnight as a rival to "Sixteen Tons." And if "Sixteen Tons," with its theme of bondage to the "company store," is a slander on the American capitalistic system as it is operated today, "Twenty-four Barrels" grossly maligns the oil industry.

The hero of this song put the winnings of a crap game into some worthless Texas land and then somebody drilled an oil well on it. Now he is rolling in wealth, has a fleet of Cadillacs, and the girls are all fighting over him. He gets in many jams, but he should worry because he has "twenty-four barrels of oil a day."

On hearing this song, the average person probably figures: "Hmm . . . let's see now . . . gasoline at 30 cents a gallon . . . 42 gallons to the barrel . . . times 24 . . . that's more than $300 a day. Pretty soft . . . pret-ty soft. No wonder Texas is full of oil-rich millionaries."

Unfortunately, the song takes considerable poetic license with the economic value of a 24-bbl. well. The facts would be more like this: The posted price of this well's crude is probably about $2.85 per barrel, so the gross value of a day's production would be $68.40. But this guy is only the royalty owner, so he gets one-eighth of that, or $8.55, less deductions for pipeline loss, gravity and temperature corrections, and basic sediment and water. And since he is in Texas he is allowed only 15 producing days a month.

This makes his total monthly income $128. Maybe that "ain't hay," but you can't buy many Cadillacs on $128 a month.

The operator, of course, gets seven times as much as the royalty owner—gross. But he had to pay the cost of drilling the well, and run the risk that it might be a dry hole. Also he had to install the pump that the song's playboy sees outside his window every day, and hire a man to keep it running. So it's doubtful that the operator's net monthly profit is much more than the royalty owner's easy-come-easy-go $128.

"But," you say, "that figure, 'twenty-four' was picked just because it fitted the meter of the song. Many oil wells produce much more than that."

True, some of them do. And others would if there were a market demand for the oil. But the average production of all the oil wells in the United States is only 12 bbl. per day—just exactly half the output of the well that is "pumping money" in the song.

The song is so patently silly that perhaps it shouldn't be taken seriously. Certainly nothing can be done about the song itself. This is a free country, and our freedoms include—alas—free verse, free advice, free radio programs, and free renderings of social and economic themes by hill-billy balladeers.

But even if "Twenty-four Barrels" isn't taken literally, it is being dinned into the ears of millions of listeners day and night. People listening to a disk-jockey program probably aren't in a mood to make a serious economic analysis of the petroleum industry. Their subconscious stores away the idea that down in the oil country all a person has to do is to look out the window and see an oil well pumping money.

Silly or not, things like this don't make it any easier for the oil industry to get the public to understand the true facts about itself and the problems of finding and producing oil and getting it to the consumer as refined products.

It's conceivable that if a few more songs like this should work their way up into the hit parade, the oil industry's public-relations program could be set back 20 years. Maybe the industry ought to hire song writers and guitar players and start cultivating the juke-box set.

We forget who it was who said it, but he said a mouthful when he said "Let me make the nation's songs, and I care not who makes its laws."

—*Henry D. Ralph.*

*By Phillips and Jeffers, Mercury Records.

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Conservation is still a mockery in Oklahoma

THE Oklahoma Corporation Commission is playing politics with the state's petroleum resources and flouting the conservation trust assigned it by the people.

In a bizarre perversion of the market-demand statute, it set crude production at a level higher than buyers say they can handle, and then ordered every purchaser and pipeline to take every barrel offered.

In October 1953 the commission tried to do the same thing, but then backed off. At that time the Journal said conservation has become a mockery in Oklahoma. It is still a mockery. The sloppy administrative practices and indifference to both letter and intent of the laws which characterized the commission then have not been corrected.

OKLAHOMA PRODUCERS THINK they are not getting their share of the market. So do producers in other states. They blame imports—which are beyond the control of the state commissions. So several states are trying to crowd out imports and create a demand for their own oil by forcing more of it on the market.

When buyers can't handle all crude available, proration results. Some states let purchasers do their own prorating. Others prorate through their conservation commissions under market-demand statutes. Only Oklahoma is trying to avoid either alternative. It is trying to eat its cake and have it too.

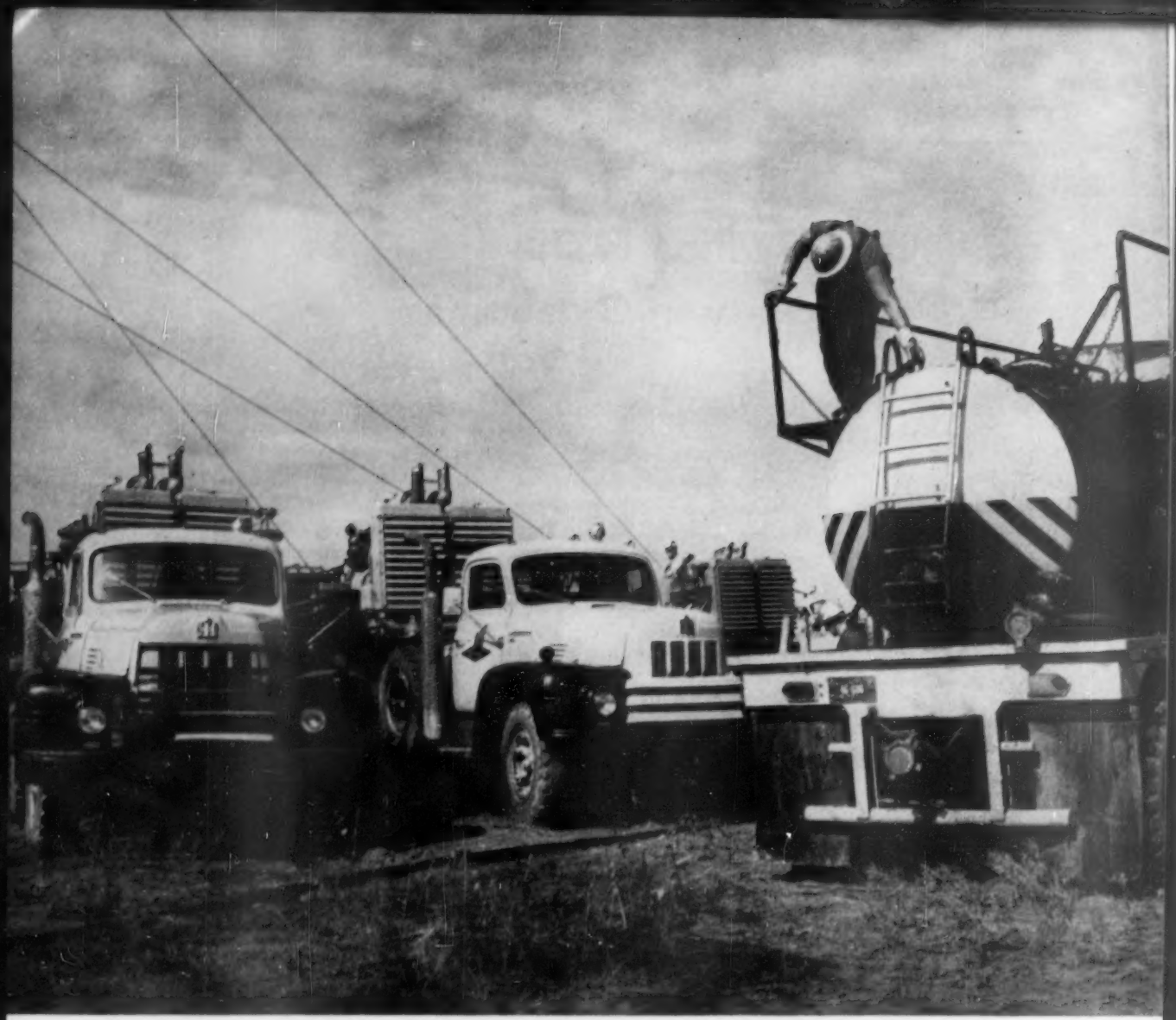
Market-demand proration is designed to prevent waste by holding crude output to what refineries will process. The Oklahoma commission has ignored market demand many times. So have other state bodies. But only Oklahoma is insulting the laws of economics and common sense by trying to make purchasers buy oil they can't use, store, or resell. That's the antithesis of conservation.

If, by some legalistic quirk, the courts uphold the commission, Oklahoma can expect crude purchasers either to cut the prices or pull out of the state entirely. No law can force them to buy what they don't want.

THE DECADENCE of its conservation system is tragic for Oklahoma. But it is a danger to other states, too. By concentrating its attention—and its political sympathy—on the natural desire of producers to sell more crude, and by warping the statutes to serve that end, the commission has thwarted the real objectives of its fine body of conservation laws.

Some other state commissions seem headed down the same road—acting more like crude salesmen than scientific conservationists. A breakdown in administration of market-demand laws could easily breed indifference to other—and really more important—aspects of conservation.

There are signs that this is happening in a number of places. Oklahoma is just a conspicuously bad example.



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Current and significant in . . .

The Industry This Week

Industry

• **The steel strike was felt immediately** by the oil industry, although the visible effects were few. It upset timetables for $850 million in refinery construction, delayed pipelines which hadn't received all their pipe deliveries. Small operators can't get pipe for new wells now and a month's strike would affect majors' plans. The most vulnerable spot in tubular goods: South Louisiana and other deep-drilling areas requiring alloy pipe. P. 58.

Ten years of postwar growth, capped by a record year in '55, is detailed in Chase Manhattan Bank study. It shows 64 per cent of free world's $63 billion in fixed oil assets to be in U. S. P. 66.

Refining

• **Rexforming has arrived.** Aurora Gasoline has put first unit on stream and Cosden Petroleum will have one operating next week. Biggest so far announced is a 15,000-bbl. unit. It's in the mill for Suntide Refining. P. 67.

Octanes above 100 will be measured by the Wiese scale. Industry groups have agreed on the compromise scale. P. 70.

Production

• **Production may soon be controlled** in Colorado's big Rangely field. The state conservation commission is drafting regulations to cut gas flaring and limit oil production. P. 71.

Plans of two big Texas floods are being blocked by an overriding royalty owner outside the units. Diamond "M" and Sharon Ridge Canyon units want to complete a water block preventing oil drainage from one to the other. P. 64.

A pilot thermal-recovery project in California has entered the combustion stage. It's located in South Belridge field, Kern County. P. 69.

Exploration

• **The strike Cuba has been waiting for** may have been made by Cuban-American's 1 Catalina southwest of Jatibonico field. Testing around 25 bbl. an hour, the well tapped the island's first deep high-gravity oil found on a structure. P. 72.

Venezuela is reoffering three high-priced blocks in Lake Maracaibo rejected recently by bidders for the country's first new oil concessions in 11 years. Official action on the other eight may be withheld pending their disposition. P. 73.

Other exploration notes: Thirteen Philippines concessions were granted to San Jose Oil (P. 74); drilling will start in Nicaragua in 2 months (P. 72); and salt-water encroachment may put two Italian discoveries by Gulf in new light. P. 75.

Pipelines-Natural Gas

• **End-use controls for conservation** of natural gas may not be an issue in future FPC hearings. The commission reversed itself last week and approved Northern Natural's plan to sell gas to Northern States Power for use as boiler fuel. Earlier decision denied sale on basis for conserving gas and low price asked for gas. P. 63.

An $84.5-million pipeline expansion to increase California deliveries 150,000,000 cu. ft. daily was laid before FPC by El Paso Natural. P. 69.

Lebanon claims ownership of I.P.C. pipeline installations; company counters with warning it may quit delivering through country. P. 75.

What the Steel Strike Means to Oil

	If it's short:	30 days or more:
Drilling	Independents who carry no steel inventory to shut down soon. No effect on majors except for cut in inventory cushion.	Larger independents will cut back. Farmouts affected. Majors must reappraise plans, drill more selectively, delay some starts, especially in deep areas requiring alloy pipe. After effects will plague industry months after mills start producing again because strike will play havoc with inventories essential to smooth operations.
Refining	$850 million worth of projects delayed. Octane schedules upset by holdup in huge cat-reforming program.	On-stream dates shoved back further, new plants postponed, long-range planning held up, fabricators will start shutting down.
Pipelining	At least seven major lines set back a month.	New lines postponed, many current projects delayed by at least the length of strike. Mills already booked up 2 years ahead.
Production	No effect. Equipment inventory fairly good.	Maintenance may be hampered, new discoveries held up in coming on production. Output level probably unaffected because of excess producing capacity.

IT looked like business as usual in the oil industry last week as the nation entered its fourth major steel strike in 10 years.

There was not the spectacle of thousands of workers being idled, as was the case in the rail industries. No rigs were stacked the next day for want of steel. No plant or pipeline construction was stopped in its tracks.

But for all the surface serenity, the impact of the strike was immediate and profound. It hit like a thunderbolt the minute mills started banking furnaces to prepare for a strike which both sides warned might be long and which cut off 2,100,000 tons of production a week, 90 per cent of United States capacity.

The shutdown immediately upset timetables for:

... **Refinery construction** estimated to cost $850 million.

... **Petrochemical and gasoline** plants which were not already nearing completion.

... **Hundreds of miles** of big-inch pipeline projects.

... **Drilling programs** of independents who buy pipe only when they are ready to start a well and who are unable or unwilling to tie up capital in inventory.

"The situation was tight enough with mills going 24 hours a day," one oil-company executive stated. "We couldn't afford to lose a single day's production."

Hardest hit will be plant and pipeline construction.

Oil men had to go back to the 1952 strike, which lasted almost 2 months, to find a time when steel had been so tight. Inventories of plates and structurals were particularly low, hence the more immediate effect on construction than on drilling. Some fabricators said a single day's strike would set back their schedules, as they are unable to stockpile materials because refinery units, for example, require such a complex variety of steel shapes. Most units are specially designed and cannot be built ahead of time.

This all adds up to a lag in many refiners' plans for new facilities to make higher octanes for the 1957 motoring season.

The impact on pipelines varies from company to company all the way from those whose programs will be impeded only slightly to those facing almost immediate shutdowns.

Virtually all major companies, which do 90 per cent of the drilling, went into the strike in good shape on oil-country stocks. Most have 3 to 6 months' inventory. But tonnages are not well balanced. Low inventories of alloy casing indicate that the majors' first cutback will be in the deep-drilling areas such as South Louisiana. A survey of companies reveals the pinch may come as early as a month from the time the strike started, even if it is settled before then.

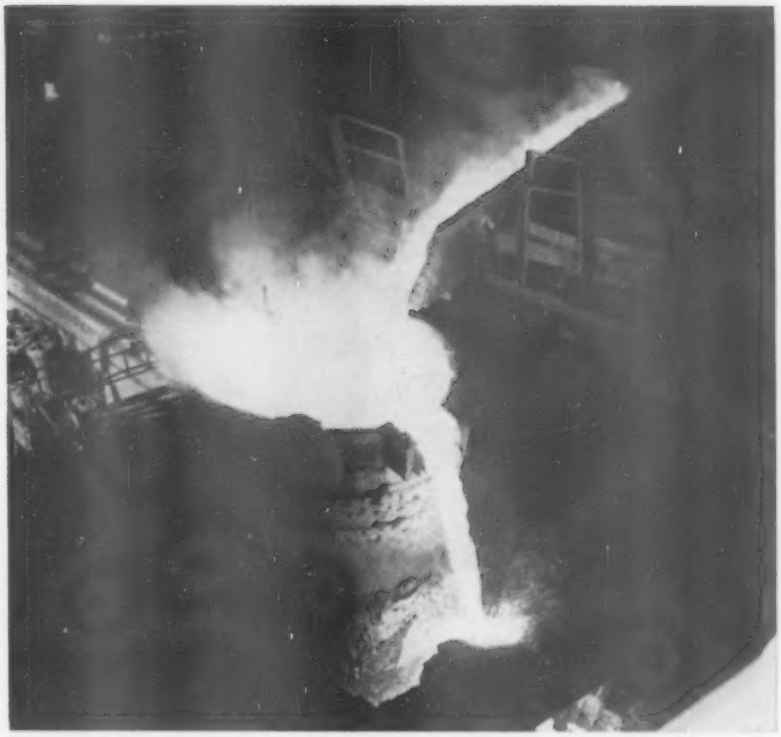
Should the strike be settled tomorrow, it would probably delay deliveries of steel at least a month. Production started tapering off several days before steelworkers actually walked out, as furnaces had to be cooled gradually. Still more tonnage will be lost after the strike ends. Some mills can start making steel within a week after furnaces are fired again, but it could take up to a month for capacity production to be reached.

Steel men estimate a month-long strike would cost at least 6 weeks' production, and could seriously cut into fourth-quarter deliveries. Mills were going at nearly 100 per cent of capacity to meet the demand, and oil companies will be a long time rebuilding inventories to a good flexible operating level.

Unlike the 1952 situation, there will

10-Year Strike History

1946—January 21-February 16
1949—October 1-November 2
1952—April 29-May 2
June 2-July 26
1955—June 30 (12-hr. layoff)



LAST STEEL IS POURED from an Armco plant June 30 as furnaces flickered out all over the nation.

be little foreign steel to help bail out operators caught with their inventories down. Much of it is tied up under barter contracts, and generally high world demand has made foreign steel as tight as in this country.

The strike will cost the oil industry heavily in two ways:

. . . **Loss of revenue** from new projects whose completion is delayed.

. . . **Higher prices** for steel—probably at least 8 per cent higher.

Steel went up $7.35 a ton last July when the union won a 15-cent hourly pay hike. Companies this year have already offered wages and other benefits which they figure to be worth more than 17 cents an hour. With prospects that a settlement may be for around 20 cents an hour, the industry can expect a basic steel hike of $8 to $10 a ton. And this in turn points to a bigger increase in oil-country steel than a year ago, when tubular goods went up 7 to 8 per cent.

Refining

Whether the steel strike is a short one or a long one, it will delay directly some 200,000 bbl. per day in new crude units, 150,000 bbl. per day in catalytic cracking and over 200,000 bbl. per day in catalytic reforming. It will also set back work in hydrogen treating, alkylation, polymerization, and other auxiliary processing units.

Over and above these critical projects which are scheduled for completion late this year or early 1957 are scores of programs which are on the drafting boards. They will be delayed indefinitely in the letting of contracts. Some construction jobs which are well along may run into trouble through the lack of some vital materials which may be delayed by rescheduling or outright shortage.

The completion schedules of two major East Coast refineries are not expected to be affected. They are the 130,000-bbl. Tidewater Oil Co. plant near Wilmington, Del., and American Oil Co.'s 35,000-bbl. Yorktown, Va., refinery. Only a catalytic reformer is possibly subject some slight delay at the Amoco project.

Critical areas . . . Refiners will be hurt most by delays in cat-reforming construction, needed to produce the ever-higher octanes demanded by new cars and competition. Delays will leave some at a competitive disadvantage.

Many companies are on their second round of adding new capacity and others, hard pressed to keep up with the rest of the industry, are anxious to complete their first units.

The addition to crude capacity will presumably affect the over-all industry economy less seriously.

The amount of delay the active building program will suffer is anybody's guess. But it is clear that the strike has already put a severe crimp in new building. It will certainly begin to be felt in the field by October or November. If the strike is prolonged, the delay will lengthen for at least the same period, and probably longer. Fabricators are expected to start shutting down in about a month.

Contractors pinched . . . The engineering-contracting firms which build processing units are going to feel the strike critically.

For some time they have been in the middle of a squeeze. Their clients in the refining industry want fixed-price contracts and get them. On the other hand, vendors and fabricators have been wary of committing themselves on the same basis and have written escalation and escape clauses into dealings with primary contractors. This situation has amounted to thin ice for contractors for some time. The strike is propelling the situation rapidly from bad to worse.

Unlike some other major steel users, such as the auto industry, construction contractors do not stockpile materials ahead of their needs. Several companies said their operations were affected the day the steel industry started banking furnaces. It will be possible to continue for some time in the designing and planning departments, but when the holdup hits the field, many companies will have to shut down there and risk losing field forces which will be difficult to call back later.

In some instances, oil company customers may be able to step in and help procure such items as line pipe. In cases where this material is a bottleneck, some relief will be possible. But structural shapes and, to a lesser extent, plate and specialty tubular goods, are generally outside the realm of oil-company purchases and there the pinch will hurt.

Fabricators and contractors' fears of added delays in steel shipments were compounded by the Department of Commerce, which reserved many plate and tubular types for the military and the Atomic Energy Commission. This will cause rescheduling of available stocks and will hasten the shortage dates on some types required for refining

Market loss . . . Refiners will be hit also by loss of one of their major markets for residual fuel for the duration of the strike.

The steel industry consumes about 1,000,000 bbl. a week. The loss of this outlet will result in an increase in stocks and perhaps a softening of Group 3 resid prices. Heavy fuel has been tight on the East Coast, and a price increase was posted there recently.

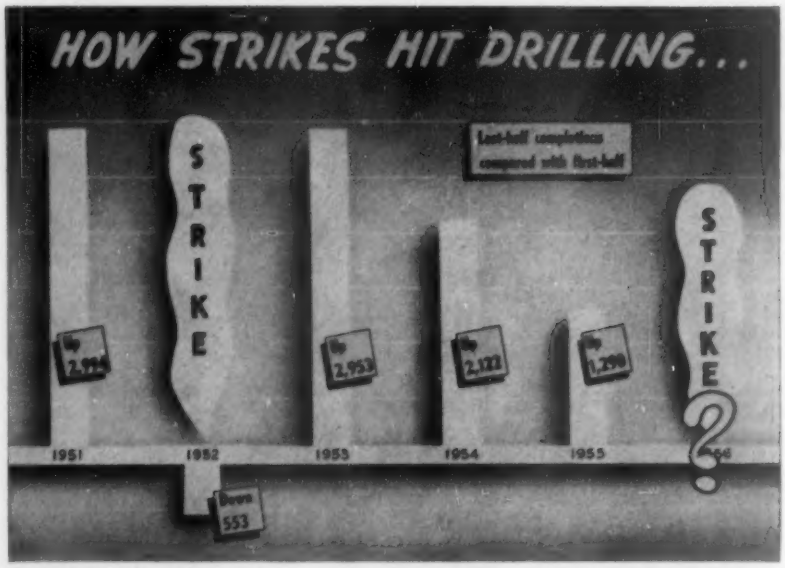
Stocks should present no great prob-

lem, however, in a strike of up to 2 months. They are now 8,000,000 bbl. below the 1955 level.

The outlook . . . Tight scheduling of materials and field installation is highly important in coming out on the right side of a contract these days. But right now, some of the most carefully planned jobs are going to be blown sky high.

Postponement of many going projects will delay the octane schedule and the industry's ability to keep pace with other important product qualities. The strike will most severely affect the progress in making better fuels. If extended it may even cripple the industry's ability to produce the quantity of certain products now enjoying a steadily rising demand.

Whatever the outcome of the strike, new facilities coming on stream next year are going to cost more. So refiners had better brace themselves for a pinch in dollars, days, and detonation in the new high-compression cars.



COMPLETIONS in the last half of the year normally are considerably above the first half totals. An indication of what could happen as a result of this year's steel strike is shown in this comparison of 1952 with 1951 and following years.

Drilling

A check of companies on the drilling outlook produced dire predictions that contractors would start stacking rigs 2 weeks after the strike began.

But the weight of opinion was that it would take a month's strike to cramp anyone but a minority of the independents. And even with the loss of a month's mill output, many majors expressed confidence they could come close to carrying out their 1956 well programs.

It is impossible at this stage to gage the impact on total completions. For that matter, it will be almost as difficult at the end of the year to determine what effect the strike had on completions. Perhaps the best guide is what happened in previous years.

The last strike . . . The industry always drills considerably more wells the last half of the year than the first half—under normal conditions.

The only exception in recent years was 1952. Completions were up 2,994 wells or 14.4 per cent (see chart) the last half of 1951, but the same period in 1952 saw a decline of 553 wells. That 8-week strike cut completions substantially.

Drilling ran at a record pace the first 6 months of 1956. There were approximately 28,850 wells drilled through June 30, and it would take a long strike to drop the total for the rest of the year below that figure. Even in 1952, completions were around 1,200 above the previous year.

Any cut by the majors can be expected to show up in the fourth quarter, and will be felt by drilling contractors and service companies as well. The number of active rigs began to drop shortly after the strike started in June of 1952 and it took the rest of the year to get the total back to the June 16 level.

Drilling contractors themselves appear to be fairly well fixed for drill pipe. Some say they could operate for 6 months to a year on the pipe they have now.

A measure of relief on tubular goods and line pipe will be provided by the 10 per cent of the mill capacity which was not struck. Lone Star Steel Co., Daingerfield, Tex., and Kaiser on the West Coast have contracts with steelworkers which expire in 2 months and no strike is expected then. Acme Steel in Chicago and a few other plants also are operating.

Programs will change . . . The effect on well programs will vary widely from company to company because of sharply contrasting inventories. The independents who are big enough to carry 30 to 90-day stocks will take another look at their plans.

"We'll start getting mighty choosy about where we drill," one remarked.

"After a strike of 1 month our company would have to ease up on development, concentrate on prime wildcat locations, and drill to prevent leases from expiring," a major company exploration executive said.

"We have a lot of tonnage," another executive reported, "but there are a lot of cats and dogs mixed in. Pipe never comes out even and there are a lot of sizes that we ordered but for some reason or other never used. A strike of more than 30 days might see us putting steel down a hole that we wouldn't use otherwise. We will be using sizes and grades that we would never even consider if the supply picture were different."

Another foresees an increase in per-well costs because of the necessity of moving pipe long distances to the points it is needed. A company with a big inventory but far-flung operations might end up with the casing and tubing a thousand miles from a well location. Inability to swap or borrow as is done in normal times will result in greatly increased freight costs.

Offshore . . . Operators in the Gulf of Mexico would be hit hard by a prolonged strike, and they will feel the effects of a short one.

They will be pinched three ways:

. . . Delays in building offshore platforms, for which structural steel was short before the strike.

. . . Shortage of high-strength casing for deep wells.

. . . Delays in marine pipelines.

If the strike lasts through the summer it would just about kill plans for gas lines from several undeveloped fields in the gulf. Several gas fields have been discovered on leases expiring August 7, 1958. That leaves a relatively short time to complete pipelines to hold leases by production. Only 4 or 5 months out of the year are suitable for laying such lines.

Although plans for offshore gathering systems have not been announced, several operators apparently have them

under consideration. The Tennessee Coal & Iron plant at Birmingham, a big supplier of steel used in gulf operations, was shut down 45 days before the nationwide strike started.

West Coast . . . California operators believe they are in a better position regarding tubular goods than Gulf Coast operators.

There appeared to be a lone exception on the West Coast. This major company said:

"We have just enough casing to complete wells now drilling and to go ahead with some wildcatting on a highly selective basis. We will have to curtail all development drilling. We have enough tubular goods on hand to last only 2 or 3 weeks."

Foreign operations . . . American firms operating abroad are in the same boat as the domestic operators.

The concensus is that a strike of any duration is going to be felt, but it will take a prolonged shutdown to make the drilling pinch really painful. One major company purchasing agent said that one day's shutdown generally means a week's delay in deliveries.

Although reluctant to make any predictions, most agree that the oil-industry outside the U. S. can weather a 30-day strike. If it extends beyond that period, it will hurt.

For non-American companies, it's a different story. They're expected to be affected very little. Most buy materials on the world market and at the best prices and supply obtainable. They will merely shift their American buying to European steel suppliers where they already do some business.

Government's Role

While the Government played the dominant role in the 1952 strike, when it tried unsuccessfully to sieze and operate the plants, it is remaining in the background this time.

Officials in Washington are sweating out the strike, hoping it doesn't last so long it upsets the economic balance.

They kept out of the pre-strike talks. They are trying to stay out of the picture as much as possible. They would like the industry to work out its own problems because there are principles involved which go beyond the bare issues.

Other than to help bring the two sides together, the Government has no present plans for any action. The Labor Department's position was made known by Secretary James P. Mitchell as the strike began. The men on both sides, he said, are "mature, intelligent people" who recognize their responsibilities to labor, management, and the public.

J.&L. May Build Houston Mill

HOUSTON.—Jones & Laughlin Steel Corp. has revealed tentative plans for construction of a steel mill near here having a capacity of 1,000,000 tons annually. Ingots produced at the mill would be fabricated into seamless pipe for the oil and gas industry.

Adm. Ben Moreell, chairman of the board, said the proposal is in the formative stage and has not yet been submitted to the company's board of directors. Cost of the project has been estimated at between $250,000,000 and $350,000,000.

A company spokesman said site for the proposed plant has not been acquired. Source of ore for the mill was not disclosed.

The Government, which stockpiles critical metals, froze certain steel goods last week to keep defense production unhampered for as long as possible. The order was expected to remain in force no more than a few weeks.

The alternatives . . . The Government has two ways of getting into the picture. One is the drastic way of the Taft-Hartley Labor Relations Act. The other is through the Federal Mediation Service. Last week, Joseph F. Finnegan, director of the service, held post-holiday talks with union and management in an effort to get new negotiations started.

Although steel supply was already tight when the strike started, the situation would have to get much worse before Taft-Hartley would be invoked. To set that law in motion, the President would have to find that a national emergency had developed.

A federal court injunction would be obtained. That would require the strikers to return to work for 80 days while a fact-finding panel studied the controversy and recommended how it should be settled.

Prices Go Up

Various small steel producers whose plants aren't struck raised prices last week in anticipation of a general increase.

Cold rolled alloy bars were raised $9 a ton, hot rolled bars $5, hot and cold rolled sheets and strip $8, plate $9, low carbon sheet and strip $8 to 12, and rod and wire products $7 to $16. These producers appeared to be trying to second guess big steel's plans because they will give workers the same benefits retroactive to July 1.

Taft-Hartley proceedings make no one happy. They have been used sparingly—and not at all by the Eisenhower administration. Few government officials believe the strike will run so long as to leave the nation in an emergency.

Pipelines

If the strike ends before August, there might be some prospect of 1956 pipe orders being delivered for oil and gas lines before the end of the year. After the 1952 strike, deliveries came through at such a fast rate that pipe on order reached construction spreads within the calendar year. Construction was carried on late in the fall and early winter. Footage in the ground for 1952 was actually up to predictions at the beginning of the year.

The strike will naturally deter planning for new fall construction. But when it is settled and new prices are announced, long-range planning is expected to be resumed on a normal scale.

The effect of the strike on pipelines varies all over the map.

Here is a summary of the situation on the major projects:

. . . El Paso Natural Gas Co.'s situation probably represents the average or middle position for the industry generally. A short strike would not hurt El Paso's 515-mile program. But the loss of a few weeks' steel output would force a slowdown in pipe laying.

. . . Trans-Canada Pipe Lines, Ltd., is holding to its objective of completing the 574-mile, 34-in. Alberta-Winnipeg segment of its 2,250-mile gas line by the end of the year. That is the deadline set by the Canadian Government in the bill granting a loan for the project. Private financing will be completed as previously expected to repay the loan by March 1957.

But Trans-Canada could be in trouble for pipe. It has only 115 miles of 34-in., some of which has not been shipped to Canada. A reduction in the pipe-laying program calling for seven spreads is assumed until more pipe is in sight. Four spreads have already been contracted. Three more are to be contracted soon.

Trans-Canada would have had a bigger stockpile, perhaps, but for the shutdown nearly 2 months ago of the plate mill of Tennessee Coal & Iron at Birmingham, Ala. This plant turns out plate for the Orange, Tex., National Tube mill which is handling part of the Trans-Canada order.

. . . Westcoast Transmission Co., Ltd., already has 372 miles of pipe on hand—enough to carry on this year's program for its Peace River-Sumas, Wash., line. British pipe is being relied

on for 1956 plans. A South Durham plant in England will continue to ship Westcoast 6,000 tons of pipe per month. Next year the company must look to the United States for pipe to complete the project.

... **Pacific Northwest** Pipeline Corp. is getting pipe for completing its gas line from Kaiser Steel Co., whose contract with the union runs until August 30. All spreads working on the line, extending from the San Juan basin to Puget Sound, are laying pipe as fast as it arrives. About 1,750 miles has been laid so far.

... **Colorado Interstate** Gas Co. will be shut down almost immediately. It has just started to lay 238 miles of 22-in. from Laramie to Green River, Wyo., but has only a week's supply of pipe. About 1,000 ft. had been welded and less than 3½ miles had been strung early last week.

... **Plantation Pipe Line Co.** started laying pipe June 1 with one spread on its 327 miles of 18-in. from Baton Rouge, La., to Helena, Ala. Enough pipe is in sight for this spread but not enough to supply a second spread planned originally.

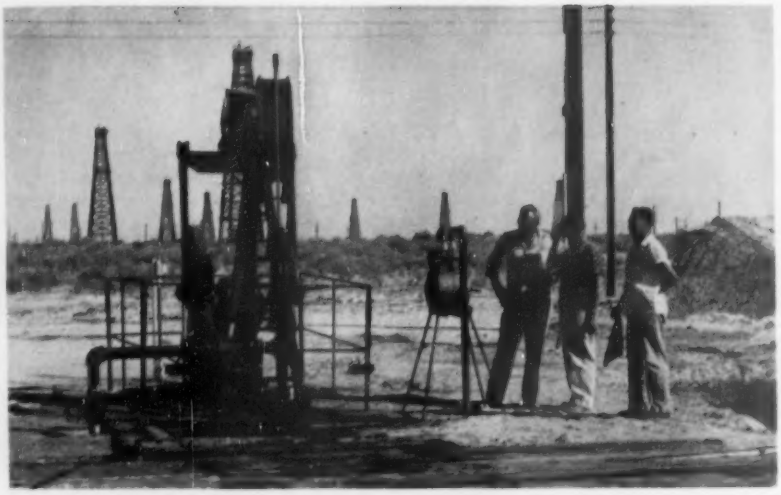
... **Southern California Gas Co.** and Southern Counties Gas Co. will be able to complete a 49-mile segment of 30-in. on their Newhall to Alhambra phase of the Topock, Ariz., to Los Angeles line. But contracts have not been awarded for the 236-mile stretch from Newhall to Topock, and a long strike could delay the pipe-laying start set for October 1.

... **Tennessee Gas Transmission Co.** is in good shape to weather the strike. T.G.T. has nearly completed the big 255-mile "Muskrat" project laid largely under water in the Louisiana delta country and offshore. Pipe is also available for the 221 miles of looping scheduled this year in Kentucky and Ohio.

But T.G.T. might run short on another looping program planned for the near future in Kentucky, Ohio, and Pennsylvania, if the strike becomes extended.

... **American Louisiana** Pipe Line Co. has all its 30-in. pipe on hand for laying the 250 miles remaining to complete the 1,160-mile line from North Tepetate to Detroit. So the main-line completion is expected on schedule in 60 days. But pipe has not been delivered for the 121-mile, 22-in. lateral from Defiance, Ohio, to Bridgman, Mich., for which construction is scheduled to start in August.

... **Transcontinental Gas** Pipe Line Corp. could receive a setback from even a short strike on its 30 and 36-in. looping planned to start in August. So far only about 40 miles of pipe has been delivered.



Torch Applied to "Fire Flood" Project

BAKERSFIELD. — The combustion phase of a pilot thermal-recovery experiment at South Belridge field in Kern County is under way.

The reservoir was ignited in the upper portion of the Tulare zone at about 700 ft. Underground combustion is controlled by the amount of air injected by compressors into the burning zone. Air was pumped through an injection well.

Theory back of the project: Reduce the viscosity of low-gravity crude and drive it ahead of the burning front to effect recovery.

Results of the in situ combustion will not be known for some time. The project is scheduled to continue for several more years. General Petroleum Corp. launched it last July *(The Oil and Gas Journal, July 25, 1955, page 133).*

Several other companies are in on the project with GP. They want to know if it is feasible to recover low-gravity crude by this method. Tulare is typical of a number of California zones where primary recovery methods leave large deposits of heavy crude in the ground. It produces 13°-gravity crude

GP's "fire flood" uses a five-well pattern, with four producing wells on one injection well. Spacing is 330 ft. Estimated cost is $1,000,000.

Standard Oil Co. of California followed up the GP experiment with one of its own a month later. Using a central injection well with three producing offsets, Standard located its test in Midway-Sunset field, 30 miles west of here *(The Oil and Gas Journal August 22, 1955, page 98).*

Union squelches report of . . .

. . . Phantom Offshore Well

LOS ANGELES.—Union Oil Co. of California last week denied rumors touched off by a deep-sea diver that the company has been completing wells on the ocean floor and then shutting them in.

The diver reported finding such a well off Coal Oil Point in Santa Barbara County. He said the well was complete with christmas tree and needed only a pipeline connection to shore to put it on production.

The location is in an area where Union recently conducted core-drilling operations.

A Union official admitted that what the diver found could some day be a producing well. But he said the structure, at the moment, is just a large drilling base designed to combat cratering difficulties the company had experienced while core drilling in that particular area.

He described the base as a heavy hexagon-shaped structure of steel measuring 8 by 16 ft. Surface pipe is set through the base.

Union's practice, the spokesman said, was to leave the drilling base, surface casing, and control valve cap in place when coring showed good possibilities of eventual production from the hole.

That way, he explained, the company would save much time and effort if it later obtained a lease in the area.

While the diver reported finding only one such structure, Union said it has others.

End-Use Case Reversed

Northern Natural wins right to sell gas for boiler fuel after FPC chairman changes vote in controversial ruling

WASHINGTON.—The Federal Power Commission last week backed away from end-use controls for conservation of natural gas.

It reversed a March 16 order barring the sale of gas for boiler fuel by Northern Natural Gas Co. to Northern States Power Co.'s Black Dog generating station *(The Oil and Gas Journal, March 26, page 76)*.

A rehearing of that decision, the FPC said, cleared up questions of supply and price on which the order was based. Northern Natural can go ahead and sell the gas.

First ruling . . . The conservation issue was first raised by the examiner hearing the case.

Last August, Examiner Hall denied Northern Natural's application. He took the position that the unhealthy condition of the coal industry, conservation, and below-cost prices which he said would throw a burden on other customers, made the boiler-fuel sale undesirable.

Hall's views were adopted bodily by Commissioners William R. Connole and Claude L. Draper, who retired last month. Commissioners Seaborn L. Digby and Frederick Stueck voted against the assumption of conservation powers by the FPC.

Chairman Jerome K. Kuykendall, who didn't go along with the conservation argument, held the deciding vote. He didn't think Northern Natural's price was enough to cover the cost of the gas it wanted to sell. He voted to affirm the examiner's decision, making the Connole-Draper opinion the majority ruling.

New ruling . . . Last week Kuykendall reversed himself and the commission.

He said he found his March 16 position "not tenable." A May 1955 opinion laid the basis on which Northern Natural apparently relied in contracting for the Black Dog sale, he explained.

Kuykendall voted with Digby and Stueck to reverse the original decision. Draper's successor, Judge Arthur Kline, did not participate. But Connole adhered to his position.

The new majority opinion did not go into the question of conservation. It said merely that the FPC now finds that Northern Natural's gas supply is sufficient to support the sale of an estimated 14,400,000,000 cu. ft. this year to the Black Dog station.

The price to be paid, the FPC added, now is deemed sufficient to assure recovery in excess of the proper allocation of the cost of the service.

"The private interest which might be adversely affected by this competitive sale must yield to the public interest requiring the issuance of a certificate," the order said in referring to the contention that there was an abundance of coal available to the Black Dog plant.

The new order, however, does not close the door to conservation action if conditions made it necessary in the future.

The authorization could be modified to require Northern Natural to curtail deliveries if it is demonstrated that public convenience and necessity so require. This condition will "materially assist in removing the disadvantages that previously influenced the denial of the authorization," the FPC said.

Gas Going to Canada

Panhandle Eastern to sell gas to Union of Canada

WASHINGTON.—The Federal Power Commission last week reversed an examiner's opinion and granted Panhandle Eastern Pipe Line Co. authority to export gas to Canada.

Panhandle now can deliver a maximum of 15,500,000,000 cu. ft. of gas annually to Union Gas Co. of Canada. The export was provided for in an option and order covering 13 proceedings consolidated from hearings held last year.

Panhandle is given permanent certificates for facilities to cost some $36,249,000 which will increase the sale capacity of the system by 310,000,000 cu. ft. daily. The company also may sell an additional 13,400,000,000 cu. ft. per year of storage gas to Michigan Gas Storage Co., and 6,000,000,000 cu. ft. per year to East Ohio Gas Co.

A permanent certificate also was granted Trunkline Gas Co., a subsidiary of Panhandle, for facilities costing $17,686,000. The facilities will increase Trunkline's capacity 85,000,000 cu. ft. daily to a total of 375,000,000 cu. ft. per day. Trunkline may deliver 80,000,000 cu. ft. of the additional gas to Panhandle, less any volumes required by other customers.

The export application was turned down by Examiner Howell Pardue last March.

He relied on what he considered to be a shortage in Trunkline's gas supply, the danger of future inadequate peak period gas availability in Panhandle's supply, the desirability of encouraging Panhandle to develop Howell field in Michigan as a storage reservoir, and the "adverse effect of the export of gas on domestic coal industry."

The commission disagreed with all of these findings.

Lopez Field Leases Sold

SAN ANTONIO.—Eighteen producing leases in Lopez field of Webb and Duval counties have been purchased by newly formed Slick Secondary Recovery Corp.

The properties, containing 107 wells, were formerly owned by Mortimer & Springer of San Antonio and the Mills Bennett Estate of Houston.

Current production from the leases is approximately 10,000 bbl. a month. Since Lopez field was discovered in 1935, they have produced 9 million barrels of the field's total 20 million barrels.

Lopez produces from the upper member of the Mirando sand series at a depth of about 2,300 ft. The north portion of the field was unitized late in 1955 by Humble, Magnolia, Sunray, and Jake Hamon. Water injection was started in the unitized area last November.

The Slick company plans a waterflooding operation of its own at a later date.

Sinclair Hits in Deep Water

MORGAN CITY, La.—Sinclair Oil & Gas Co. last week opened another new field in the Gulf of Mexico off the Louisiana coast.

Its discovery well, in Block 175, Eugene Island Area, is 40 miles from land in 87 ft. of water. It is 75 miles from nearest land base, at Morgan City, in St. Mary Parish. Location is 12 miles from nearest other field, in the federally controlled outer Continental Shelf region.

The well, 1 OCS 0438, was drilled to 13,004 ft. but is productive from Miocene sand at 11,830-38 ft. Initial production was at the rate of 417 bbl. of 37°-gravity oil per day through ⅛-in. choke with pressure of 4,400 psi. and gas-oil ratio of 1,275 cu. ft. per barrel.

Associated with Sinclair in the operation are Sohio Petroleum Co., El Paso Natural Gas Co., and Peoples Production Co., a subsidiary of Peoples Gas Light & Coke Co., Chicago.

Royalty Owner Blocks Two Texas Units

SNYDER, Tex.—An overriding-royalty owner is proving a big thorn in the side of two giant unitized water floods in West Texas.

These are the Diamond "M" Unit in Scurry County and the Sharon Ridge Canyon Unit, which adjoins Diamond "M" on the south and laps over into Borden County.

Both operate perimeter-type water floods of the 6,800-ft. Canyon Reef pay with input wells ringing the unit boundaries. Each has completed its perimeter except for a 2-mile stretch along the common boundary.

Both operators, Lion Oil Co. for Diamond "M" and Warren Petroleum Corp. for Sharon Ridge, are asking the Texas Railroad Commission to let them close this gap with added injection wells. This would complete a water block between the two units and prevent oil drainage from one to the other.

The fly in the ointment is that the needed inputs must be placed on or adjoining acreage (Section 146 in the Sharon Ridge area) in which Gerald Heinzelman, a nonparticipant in the unit, has an overriding royalty.

The crucial section, Sharon Ridge Canyon Unit's Tract 5, has 14 flowing and two pumping wells. Other royalty interests and the working-interest holder, Stroube et al, are all in the unit.

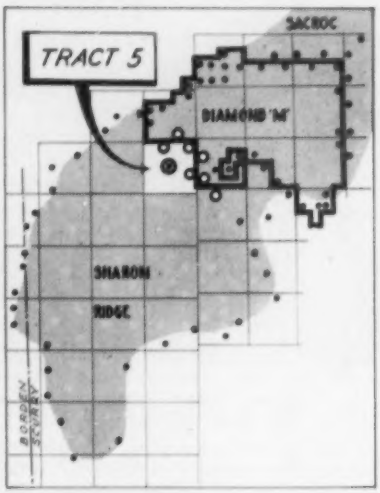
Heinzelman refused to join the unit and is actively fighting the location of any water-injection wells on or near Tract 5. He bases his argument on an unusual clause in his override agreement with Stroube which cuts his interest as production declines.

This clause specifies that the override will be trimmed from 7/16 to 7/32 "when any well on the tract does not produce its oil allowable by natural flow after a 30-day test period." The override would be cut further to 7/64 when any well produces less than 30 bbl. daily.

Heinzelman claims that the proposed new Sharon Ridge inputs, three of them to go on the section and one just to the east, would soon water out his part-interest wells and probably cut his share of the oil from the lease down to less than a fourth of what he is now getting.

He likewise is protesting three injection wells which the Diamond "M" unit wants to put in just across the Tract 5 lines on the north and east sides for the same reasons.

Oil drainage possible . . . Both units argue strongly that the input wells are vital to the success of the floods.



The three Diamond "M" inputs, says Lion's chief engineer, O. F. Zimmerman, are needed to:

. . . Complete the Diamond "M" peripherial flood pattern.

. . . Create a water block between the two units.

. . . Add injection capacity.

. . . Get response to injection in an area affected very little so far.

. . . Hike ultimate recovery from the reservoir.

Warren Petroleum's contentions, as operator of the Sharon Ridge unit, generally follow the same lines.

T. M. Ochiltree, chief engineer, points to a pressure sink on the Diamond "M" unit just east of the embattled tract. Unless the new Sharon Ridge inputs are approved, 5,000,000 bbl. of Sharon Ridge unit oil will move toward this sink into the Diamond "M" unit area, Ochiltree says. A look at the average field-wide pressures in the two units, he contends, shows clearly that loss of oil and pressure from Sharon Ridge to the north is inevitable with present facilities.

Average pressure in Sharon Ridge was 1,640 psi. last January but only 1,324 psi. in Diamond "M."

Pressure history of the huge Sharon Ridge unit shows that water injection halted declining pressure at 1,640 psi. for about 6 months but that from January to April of this year it had fallen 7 psi. to 1,633 psi.

Ochiltree thinks plugging the gap in the input ring might arrest the drop. Along with the oil lost to the other unit, Sharon Ridge would lose still more via shrinkage of the oil if pressure in the center of the field is permitted to drop further.

Solution difficult . . . Warren claims that Heinzelman would have received $3,000 more a month from his interest if he had joined the unit . . . this due to an unusually thick reef section under Tract 5 and to the participation formula based 50 per cent on gross acre-feet of pay.

The unit operator says that Heinzelman had been invited to join the unit without prejudice to the override contract and that the offer is still open.

The latter said at the Railroad Commission hearing late in June that he would join but only if he was credited with a 7/16 interest in oil allotted the tract for the life of the unit. The unit claims this would give him a much greater share of field oil than he is entitled to—since without the unit and flood, his interest under the contract would have declined in a relatively short period.

Texas does not have a compulsory unitization law. And the commission cannot order any operator or royalty owner to join a unit. It could, perhaps, achieve the same effect in this case indirectly by approving the new input wells for both units.

Written briefs were to have been filed with the commission late last week by all parties.

It's possible that, no matter which way the commission goes, the squabble will eventually wind up in the courts—meaning still more delay.

It's an example . . . Proponents of a compulsory unitization law for Texas point to the situation as one of many which have hampered—and in some cases forced abandonment of—worthwhile oil conservation projects under current Texas laws.

Generally, the larger companies favor compulsory unitization in the state while most independents are opposed to it.

The Sharon Ridge and Diamond "M" Canyon Reef units together take in about 18,000 acres and 417 wells. Sharon Ridge is one of the largest units in the state with 13,500 acres and 313 producing wells.

It now has 32 input wells injecting almost 12,000,000 bbl. of water a month into the reef. Warren, unit operator, thinks flood response so far indicates the original estimate of 109,000,000 bbl. of added oil from the program is about right.

Cost of carrying out the project is forecast at about $21,000,000 *(The Oil and Gas Journal, January 24, 1955, page 69).*

Withdrawal Plan Hit

Issue brought under fire at congressional hearing

WASHINGTON.—The controversial issue of large military land withdrawals flared up again in Congress last week during a hearing to limit such actions.

Argument centered around a Defense Department plan to set aside 35,000,000 acres in the outer Continental Shelf off Louisiana as a Naval air gunnery range. *(The Oil and Gas Journal, May 14, page 106).*

The House interior committee was told the withdrawal would halt development of potential oil reserves worth "hundreds of millions" of dollars.

Chairman Clair Engle of California said he had been told that "substantial" revenues to the treasury could be involved. He quoted Assistant Interior Secretary Wesley D'Ewart as saying that "if we don't stop these military fellows they're going to wrap up two-thirds of the nation's oil reserves."

The bill under discussion would require congressional approval of military withdrawals of more than 5,000 acres. An Interior Department report, not yet cleared by the Budget Bureau, is said to suggest an amendment to make the bill apply to the Continental Shelf as well as to public lands.

Engle said he wanted more information on the matter and that he would call D'Ewart to testify.

The Defense Department plan to take over blocks in the gulf was disclosed in May. At that time it was reported that Interior Department opposition was holding the withdrawals up and that the Defense Department had agreed to keep out of areas under development.

The 35,000,000 acres sought by the military could be granted by the Interior Department without congressional action, George Abbott, committee counsel said. The department has no choice but to approve withdrawals where a "defense mission" is involved, he said.

The area in the gulf is wanted for a missile and air-to-air gunnery range.

Mr. Gus Claims New Record

GALVESTON.—A mobile drilling platform has been towed 63 miles off the coast of Texas to drill a record distance from land.

The test will be drilled in 93 ft. of water on a 103,680-acre block leased from the federal Government.

The remote wildcat will be drilled by C. G. Glasscock Drilling Co. for Shell Oil Co. and Continental Oil Co. Location is in Block A-104, High Island area.

This is the second attempt to test the large underwater block. "Mr. Gus," a $3,500,000 drilling platform, damaged a piling several months ago while preparing for the test.

The Shell-Continental test is projected to 10,000 ft. or deeper.

Offshore Agreement

Proposal being drafted on U.S., Louisiana argument

WASHINGTON.—A proposal which might keep Louisiana offshore operations from bogging down during the "twilight zone" dispute is being drafted here.

It is based on progress made at a 2-day meeting last week between state and federal officials seeking an agreement which would permit drilling to continue until the Supreme Court reaches a decision on the Louisiana Gulf boundary.

No details of the talks were disclosed in Washington, but it was indicated that all questions were ironed out.

The interim agreement is being drawn up by the Interior and Justice departments for consideration by Louisiana authorities. An Interior spokesman said another meeting will be scheduled between the Government and the state "as soon as possible."

Interior Department officials, headed by Secretary Seaton, and representatives of the Justice Department met with the Louisiana attorney general, representatives of the Mineral Board, and other state officials during last week's conferences.

The basic proposal calls for an agreement to put all receipts from offshore operations in escrow. But there are other questions, too.

The two sides must agree on the lines within which the "twilight zone" will fall. And the state has asked that companies which already have paid the federal Government for leases place the same amounts in escrow with the state.

Plant Switching from Coal

BELLE, Va.—The Du Pont Co. is planning to convert its major ammonia plant here from coal to natural gas. It is understood the firm will license the Texaco synthesis-gas process.

The plant is rated at 650 tons of basic ammonia per day, the third largest capacity of any ammonia plant in the nation. It is by far the largest still dependent on coal.

An expansion in capacity is projected in connection with the switch to natural gas.

Industry BRIEFS

MONTGOMERY, Ala.—Oil operators bid on only 18 of 88 offshore tracts offered for lease last week by the Alabama Department of Conservation. Director W. H. Drinkard said all bids probably will be turned down. The 18 tracts brought bonus offers totaling $97,854 plus annual rentals of $43,717. Offers were confined to tracts within 3 miles of shore after the federal Government protested the state's call for bids on blocks extending out to the 9-mile mark. Alabama plans another offshore lease sale August 3.

TULSA.—Crescent Corp. is buying 1,200 acres of producing properties in Acadia Parish, Louisiana, for $2,000,000. The contract is with Elge Rasberry and others. Nine wells are producing from the Moody, Duson, and Struma zones in Iota field. Net production is about 600 bbl. daily of 40°-plus-gravity crude. Crescent plans to drill more wells following a seismic program.

TORONTO.—Canadian Gulf's name will no longer be used. British American Oil Co., Ltd., took it over, along with properties of the company, early this month.

The expansion, one of the largest in Canadian oil history, just about doubles British American's assets and quadruples its oil reserves. On completion of the Trans-Canada line, B-A will become Canada's largest producer of natural gas.

The deal gave Gulf Oil Corp., Canadian Gulf's parent company, 8,178,219 restricted common shares of B-A's capital stock.

BAYTOWN, Tex.—An independent labor union has been given an overwhelming vote of confidence to continue representing most of the hourly paid employes of Humble Oil & Refining Co.'s Baytown refinery.

Baytown Employes Federation received 2,197 of the 3,062 votes cast in a representation election called by the National Labor Relations Board.

DALLAS. — Atlantic Refining Co. has bought half of Daube's Oil Department's 9.43 per cent interest in the Sholem Alechem Fault Block "A" Unit in Stephens County, Oklahoma, about 20 miles east of Duncan.

Based on present production rates, the purchase will add to Atlantic's production about 50,000 bbl. of oil annually. Atlantic already owned a 13.6 per cent interest in the unit.

Atlantic will make a "substantial cash payment" plus a reserved oil payment out of production.

U.S. Petroleum Industry Financial Data

(Million of Dollars)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
CAPITAL EXPENDITURES*:										
Crude Oil and Natural Gas	1,315	1,750	2,000	1,890	2,025	2,575	3,125	3,400	3,700	4,050
Gasoline and Cycling Plants	35	50	100	110	75	75	75	125	100	50
Total Production	**1,350**	**1,750**	**2,100**	**2,000**	**2,100**	**2,650**	**3,200**	**3,525**	**3,800**	**4,100**
Pipelines	105	170	210	175	200	250	335	325	275	190
Marine	60	125	100	75	15	35	50	100	50	35
T. Cars and Motor Transport	5	15	15	20	10	15	15	25	25	15
Total Transportation	**170**	**310**	**325**	**270**	**225**	**300**	**400**	**450**	**350**	**240**
Refineries and Chem. Plants	250	400	600	420	275	325	470	675	800	835
Marketing	200	300	225	240	275	300	280	325	350	375
Others	30	65	100	70	50	50	50	50	50	50
Total	**2,000**	**2,825**	**3,350**	**3,000**	**2,925**	**3,625**	**4,400**	**5,025**	**5,350**	**5,600**
GROSS INVEST. IN FIXED ASSETS—12/31:										
Crude Oil and Natural Gas	9,100	9,900	10,925	12,050	13,150	15,000	16,975	18,625	21,500	23,100
Gasoline and Cycling Plants	425	525	600	725	750	550	675	775	800	825
Total Production	**9,525**	**10,425**	**11,525**	**12,775**	**13,900**	**15,550**	**17,650**	**19,400**	**22,300**	**23,925**
Pipe Lines	1,325	1,450	1,650	1,800	1,850	2,050	2,425	2,700	2,950	3,050
Marine	1,050	1,100	1,150	1,150	1,100	1,100	1,025	1,050	1,025	1,000
T. Cars and Motor Transport	300	300	325	350	350	350	350	350	325	350
Total Transportation	**2,675**	**2,850**	**3,125**	**3,300**	**3,300**	**3,500**	**3,800**	**4,100**	**4,300**	**4,400**
Refineries and Chem. Plants	3,000	3,600	4,150	4,375	4,600	4,750	5,300	5,850	6,400	7,175
Marketing	2,250	2,475	2,600	2,750	2,900	3,200	3,450	3,700	4,000	4,300
Others	250	250	300	300	300	400	500	550	500	600
Total	**17,700**	**19,600**	**21,700**	**23,500**	**25,000**	**27,400**	**30,700**	**33,600**	**37,500**	**40,400**
GROSS ASSETS EMPLOYED—12/31:										
Current Assets	4,700	4,800	5,500	6,300	7,500	8,100	8,600	9,000	9,150	9,700
Fixed Assets	17,700	19,600	21,700	23,500	25,000	27,400	30,700	33,600	37,500	40,400
Other Assets	300	300	400	400	400	500	700	600	550	600
Total	**22,700**	**24,700**	**27,600**	**30,200**	**32,900**	**36,000**	**40,000**	**43,200**	**47,200**	**50,700**

*Expenditures include cost of drilling dry holes and lease acquisitions but exclude exploration expenses and lease rentals.

Chase Manhattan study shows . . .

. . . 1955 Climaxed Decade of Growth

NEW YORK.—The oil industry set new highs in consumption, in earnings and dividends paid, and in capital expenditures in 1955 to climax 10 years of postwar growth.

The complete picture of those records and the 10-year growth period for the industry is detailed in the annual financial analysis of the industry to be released this week by Chase Manhattan Bank.

The 44-page study was prepared by Frederick G. Coqueron, petroleum analyst for the bank, and is based on a review of 34 American oil companies.

These companies accounted for 58 per cent of the free world's crude-oil production in 1955 and processed 65 per cent of the output.

The world's oil industry spent $56 billion expanding its facilities in the 10 years that followed World War II and in doing so it more than kept pace with the free world's oil requirements. Of that capital expenditure total, 68 per cent was invested in the United States.

Coqueron's study reveals that the gross fixed assets of the free world's oil industry at the end of 1955 stood at $63 billion, 64 per cent invested in the United States.

Here are some of the other records cited in the study:

. . . **Free world consumption** of crude and products reached 14.4 million barrels daily in 1955, an increase of 10.6 per cent over 1954, and a gain of 103 per cent over the consumption in 1946.

. . . **Crude production** in 1955 averaged 13.7 million barrels a day, 11.7 per cent over 1954. For the first time in history, the United States furnished less than half the free world's crude-oil output. With 49.7 per cent of the free world's production, the U. S. is still the largest source of oil.

The detailed study of the operations of the 34 companies reviewed revealed the following:

. . . **Capital expenditures** in 1955 of $3,905 million bringing the total for the group to more than $27,500 million for the last 10 years. This money spent in 1955 compares with a similar figure of $3,669 in 1954. It does not include exploratory or lease rental costs, which amounted to $434 million in 1955 and was deducted from earnings.

The group's combined outlay of $2,413 million for finding and developing new reserves amounted to $1.83 per barrel of net crude produced by the group, compared with $1.76 in 1954.

. . . **Net income** of $2,668 million, a 15 per cent increase over the $2,319 million figure for 1954. About 64 per cent of these 1955 earnings came from domestic operations and 36 per cent from foreign investments.

. . . **Income taxes** of $1,700 million in 1955, plus consumer taxes on products collected for governments of another $3,119 million.

. . . **Dividends paid** to stockholders established new record of $1,117 million, or 41.9 per cent of earnings, compared with 51.9 per cent for all U. S. corporations.

It was estimated that the gross income of the entire petroleum industry in the United States, based on consumer prices, reached $21.5 billion in 1955. This compares with $19.8 billion in 1954, an increase of 8.6 per cent.

Gross fixed assets of operating divisions within American companies now stand at more than $40 billion.

Rexforming Arrives

● Aurora leads off with first installation at Detroit; newer ones getting bigger

THE world's first U.O.P. Rexformer has gone on stream at Aurora Gasoline Co.'s 42,000-bbl. Detroit refinery.

Cosden Petroleum Corp. will have one on stream next week at Big Spring, Tex., where it has a 28,500-bbl. refinery, and at least three other companies have similar units "in the mill." And the newer ones are getting bigger.

Pattern for the burgeoning crop was set by the race for higher octanes. It's part of the big switch from plain expansion to quality expansion at the nation's refineries.

Biggest of the Rexformer lot so far announced is a 15,000-bbl. unit at Suntide Refining Co.'s 75,000-bbl. Corpus Christi, Tex., plant. Refinery Engineering Co. has a brand new design and construction contract to build it.

When the unit goes on stream, about next May, Suntide expects 65 per cent of its gasoline refinery run to be 100 octane or better. The remaining production will be in the 92-94 octane range.

Suntide also will add a Unifining unit, to be completed at the same time as the Rexformer, and a Udex unit, to go on stream about 6 months later. Refinery Engineering has the Unifining contract. The other will be let soon.

Cities Service Oil Co. has a 6,000-bbl. Rexformer under construction at Ponca City, Okla. It should be in operation early next year.

Still another company has issued a contract for an 11,000-bbl. unit, but no announcement has been made on this one. Cosden's unit will have a 3,900-bbl. capacity.

Aurora's Rexformer went on stream just 13 months after Universal Oil Products Co. announced development of the process. The unit, converted from a Platformer, has a 7,000-bbl. capacity.

Rexforming is a combination of catalytic reforming and selective extraction. Low-octane fractions are separated in a Rexformer from gasolines flowing from the catalyst zone. They are retained in the system until complete conversion to a high-octane product is effected.

By continuous recycling, all low-octane material produced in a once-through reforming operation is eliminated. Flexibility of the Rexforming process permits the company to literally choose any octane number by adjusting the operating conditions.

watching WASHINGTON

... with Bertram F. Linz

Dispersal policy: a double-hold threat? . . .

HIGH administration officials are at odds over the effect of a new provision in the Defense Production Act calling for dispersal of industrial plants.

A Commerce Department official said that quick tax writeoff and other government aid would be denied new plants to be located within 25 miles of major atomic targets.

Mobilization Director Arthur S. Flemming said he did not expect such a ban. ODM officials said the dispersal provision merely supports policies already in effect. They call for the location of new plants away from target areas only where practical, consistent with law, and economically sound.

On one point only did the agencies agree. Neither the Defense Production Act nor government policy is to affect present plants.

The Interior Department didn't get into the argument. But in passing on oil projects to be given tax incentives, the particular needs of the industry are considered along with location.

The congressional dispersal policy, if applied literally, would give the Government a double hold on the oil and other essential industries. It permits not only the withholding of government aid for building new plants, but also the withholding of government contracts from new plants that do not meet the dispersal requirement.

Lobby quiz may spread to individual firms . . .

THE Senate investigation of lobbying in connection with the Harris gas bill, so far limited to groups working for or against the measure, may be expanded to take in the activities of individual companies.

A large number of companies and groups have been asked for information on the number of workers assigned to work for or against federal legislation and the expenses of such activities.

There was no indication whether the committee will call company officials to explain their political activities. But if not, the information may be used as a basis for new laws on contributions and political activity. Chairman John L. McClellan of Arkansas has hinted he will write one next year.

FPC studies issue of rates based on cost . . .

A CASE that may go far in deciding whether the prices of independent gas producers are to be regulated on a cost basis is being studied by the Federal Power Commission.

The issue is presented in rate-increase applications filed by a number of producers, including Union Oil Co., Louisiana Land & Exploration Co., and the Beloil Corp., Ltd., on sales to Transcontinental Gas Pipe Line Co.

The producers asked for an increase from 8.797 to 16 cents per 1,000 cu. ft. In hearings before an examiner they showed that the 16-cent price was in the lower range of prices in the area, but offered no testimony on costs. The examiner denied any increase. He held that testimony on field prices alone would not prove an increased rate just and reasonable.

Arguing the case before the commission, the applicants contended that cost evidence is not necessary in producer-rate cases. An effort by the FPC to link the case to the Panhandle decision in the U.S. Circuit Court was resisted on the ground that independent producers and pipelines do not operate under the same conditions.

In the Panhandle case, the court rejected the commission's allowance of fair field price on the ground it had not related costs to the rate it said was necessary as an incentive to increased pipeline production. The FPC, at any rate, should use cost as a starting point, the court held, and limit field price to the minimum needed as an incentive.

Sooner Fight Brews

Courts may get a hot potato as Oklahoma pipeline firms defy state order to take all legal oil offered to them

OKLAHOMA CITY.—A legal battle is shaping up to test the extent of the Oklahoma Corporation Commission's authority over purchasers of crude oil in the state.

In raising allowables for July and August, the commission ordered all common purchasers to take all oil offered them up to the allowable of each lease, unless specifically exempted after a hearing.

Three purchasers have already announced that they will prorate their takings below the allowables. Two have asked for hearings to obtain special exemptions, and a third has gone to court. Others are understood to be preparing a statement informing the commission that it has no legal authority to prevent purchaser proration.

Commission officials have indicated that they are prepared for a court battle to test their authority. They are supported by a brief, filed by a group of independent producers headed by W. A. (Gus) Delaney of Ada, outlining a legal basis for the commission's action.

The situation . . . Purchasers asking for commission relief are Anderson-Prichard Oil Corp. and Rock Island Oil & Refining Co.

Anderson-Prichard has been prorating in a single field, Cement, for some time. It has the only pipeline in that field, and it has applied ratable take there.

Rock Island purchases in many fields where there are other buyers, but it has not been prorating recently. It sells most of its crude to refineries in the Illinois area where Oklahoma crude is meeting stiff competition as a result of a recent cut in the price of Illinois-basin crude.

Gulf Oil Corp. has announced that it would hold July purchases to 75 per cent of its May runs, applying the cut ratably, including its own production, and will make a like reduction in its own production purchased by others. Simultaneously Gulf asked the federal district court for a temporary restraining order to prevent the commission from applying its order.

This was refused on the ground that Gulf had not exhausted its remedies before the commission and the state courts, but the way is open for the company to seek an injunction from a three-judge federal court.

OKLAHOMA CRUDE—1956
(1,000 bbl. daily)

	Bureau of Mines forecast	Purchasers' nominations	Allowables	Prod.
January	580	539	582	601
February	585	549	590	618
March	580	553	615	621
April	575	551	610	595
May	576	542	585	579
June	580	552	589	590
July	580	554	602	...

For some months purchasers have been complaining that they have had to take more Oklahoma crude than they could use, while producers have been seeking higher allowables.

Serious trouble started in April when Cities Service Oil Co. prorated 40 per cent because of a strike in the company's East Chicago refinery. While Cities Service prorated ratably among its connections, its cuts created inequities in fields where other purchasers were taking the full allowables.

By finding temporary homes for its crude and by other means, Cities Service was able to prorate only 20 per cent in May and to take the full allowables in June. However, its refinery is still shut down and officials had hinted that the company might have to resume prorating in July unless allowables were reduced.

Too much crude . . . A number of other Oklahoma purchasers complain that they are taking more crude than they can use, sell, or store.

National stocks of crude of Oklahoma origin this spring have been some 3,000,000 bbl. above last year's level, but various individual companies say that their own stocks of Oklahoma crude are much higher than that, relatively, and that they have no more storage space.

At the commission hearing to set July allowables, purchasers complained that Oklahoma production exceeds the market demand. There were frequent suggestions that purchasers would resort to pipeline proration unless the commission held down production. On the other hand, producers asked restoration of cuts in allowables made in May and June, and also asked for commission action to prevent purchasers from prorating.

Since the first of this year Oklahoma allowables have been higher than Bureau of Mines forecasts of demand for Oklahoma crude, and higher than purchasers' nominations (see table). Actual production has been higher than allowables except during months when some purchasers were prorating.

Gas Relief Studied

FPC considers emergency sales without certificate

WASHINGTON.—A new rule permitting immediate sales of gas where necessary to protect an independent producer from loss is being studied by the Federal Power Commission.

The rule would provide that, in the event of an emergency, a producer could initiate service and continue it pending final action on his certificate of application.

But to do this it would be necessary to have an application on file, as well as an effective rate schedule. The purchaser would have to have authority to build facilities to accept delivery of the gas.

The FPC said experience has indicated a need to provide for immediate service where even the normal regulatory lag in the processing of applications for temporary permits may result in losses to the producer.

These losses might arise from drainage by adjoining wells, possible loss of lease from nonproduction, hardship resulting from payment of shut-in royalties, or lack of income due to excessive flaring of gas.

"Public interest in sound regulatory processes neither requires nor justifies that these economic burdens be borne by the producing segment of the natural-gas industry," the FPC said.

Interested parties have been given until July 20 to submit written views and comments on the proposed rule.

Premier Oil Refining Sold

CHICAGO.—City Products Co. has purchased Premier Oil Refining Co. of Texas for $3,500,000 cash plus an undisclosed additional consideration.

The deal puts City Products, an exploration and production company, into the processing phase of the industry. The company has interests in 55 producing wells in Kansas, Oklahoma, and Texas.

Premier operates refineries at Fort Worth, 8,000 bbl. daily; Longview, Tex., 4,200 bbl. daily; and Baird, Tex., 2,500 bbl. daily. Its 5,000-bbl. Arp, Tex., plant is shutdown. The company also owns a 750-mile crude pipeline system serving the refineries and holds interests in 57 producing wells.

TESTIMONIAL DINNER in Chicago brought many old friends* as . . .

Industry Honors "Ash" on Retirement

CHICAGO.—H. T. (Ash) Ashton, described by friends as a "man whose imprint of personality on thousands of friends and colleagues has been inimitable and unforgettable," was honored in his retirement at a dinner June 28 at the Sheraton-Blackstone Hotel here.

Friends from all parts of the country attended. Personal messages came from many others unable to attend the dinner. Gifts included a color television set and a check for Ashton's favorite charity.

Ashton retired as head of the central marketing region of Socony Mobil Oil Co., Inc., July 1, after a career of more than 40 years in the oil industry. He will live in Clayton, Mo., and maintain an office there for consultant work.

While in charge of Oklahoma sales and refineries for Pure Oil Co., Ashton was one of the founders of the Natural Gasoline Association of America. He is generally credited with coining the phrase "natural gasoline" for products of what was formerly known as casinghead gasoline plants.

For several years he was the head of Lubrite Refining Co. and became head of the Lubrite division of Socony Mobil when the company took over the Lubrite refinery and marketing facilities.

With associates he developed a thermal cracking process for the Lubrite refinery. For this and other scientific and industrial accomplishments the degree of doctor of science was conferred on him by Miami University, his alma mater, in 1948.

Ashton has headed or served on numerous committees of associations and the federal Government, including the National Petroleum Council and the Petroleum Industry Advisory Committee.

As one of the founders of the 25-Year Club of the Petroleum Industry, he served as president in 1946. For several years he has been secretary of the club and will continue in that capacity.

*Left to right: A. L. Nickerson, president, Socony Mobil Oil Co., Inc.; H. T. Ashton; Dwight F. Benson, vice president, Standard Oil Co. (Ind.) and master of ceremonies; W. W. Vandeveer, Ashland Oil & Refining Co.; and Fayette B. Dow, general counsel, National Petroleum Association.

Tape Will Wrap Pipeline

DETROIT—Plastic tape will be used to wrap American Louisiana Pipe Line Co.'s 126-mile, 22-in. line from Defiance, Ohio, to Brigman, Mich. This will be by far the largest use of plastic tape in pipeline construction.

Earlier this year, American Louisiana became the first company to use tape on a big scale when it taped a 10-mile test section of its 30-in. line from Louisiana to Detroit. This work was done in Tennessee by Houston Contracting Co. *(The Oil and Gas Journal, June 25, page 98).*

The same type of material will be used on the 126-mile line as was used on the test section. This is a polyethelyne tape of 12 mils thickness which is applied directly to the pipe without use of primer. It has its own adhesive. An outer wrap for the tape is also applied; this is a bitumen-impregnated glass mat which is not bonded to the tape.

Houston Contracting Co. and H. C. Price have a joint contract for the 126-mile line. Houston will lay 75 miles on the eastern end and Price the remainder.

Gas System Planned

Big El Paso project would boost supply to California

WASHINGTON. — An $84,500,000 project to add 150,000,000 cu. ft. daily to California's gas supply was filed with the Federal Power Commission last week by El Paso Natural Gas Co.

The company plans to build 888 miles of field lines and main pipeline, with 56,990 hp. compressor capacity, in Texas, New Mexico, and Arizona. The additional gas would be split equally between Pacific Gas & Electric Co. and two southern California companies.

Southern California Gas Co. and Southern Counties Gas Co. would take 50,000,000 cu. ft. of the new gas at a point near Blythe, Calif. Their remaining 25,000,000 cu. ft., as well as all the 75,000,000 cu. ft. for Pacific Gas & Electric, would be delivered near Topock, Ariz.

The gas would come from the Permian basin and Panhandle fields in Texas, and the San Juan basin in northwestern New Mexico.

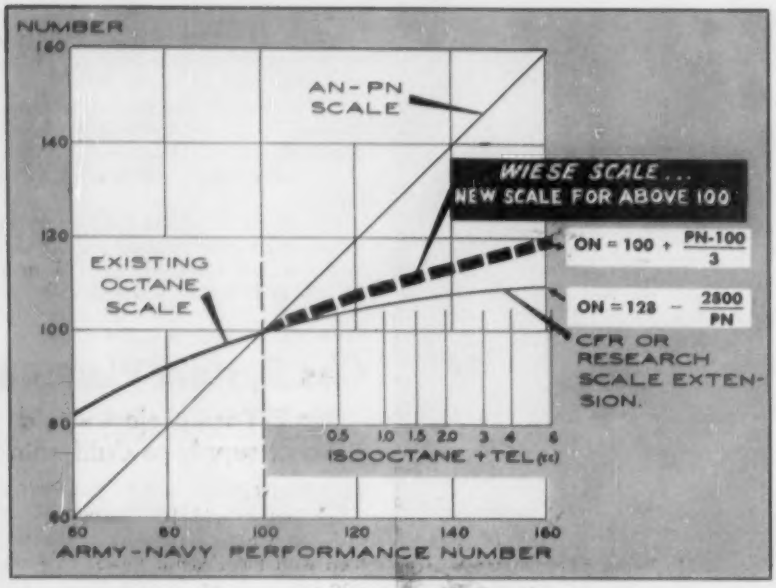
El Paso now is authorized to deliver a total of 863,130,000 cu. ft. of gas daily to the two southern California companies jointly, and 858,080,000 cu. ft. daily to Pacific Gas & Electric.

Casing Set in Offshore Hole

SANTA BARBARA, Calif.—Richfield Oil Corp. is setting casing before running tests on a 5,000 ft. core hole drilled from their floating barge about 1 mile offshore from Pelican Point, Santa Barbara County. This test, like similar ones drilled at Rincon earlier this year, will be plugged and abandoned after the tests.

Last March, Richfield set what was believed to be a depth record for holes drilled from a floating barge when they sank a 4,100 ft. test at Rincon.

The current core hole was drilled by Richfield as operator on the 3,800-acre Coal Oil Point state lease it holds with Honolulu Oil Corp. and Signal Oil & Gas Co. Richfield has 50 per cent.



Octane Scale Adopted

New scale for octanes above 100 has high correlation of octane number and performance, reflects increased costs

NEW YORK.—The extension of the octane-number scale above 100 is going to be the Wiese scale.

The decision finally agreed upon was a compromise between performance numbers and research octane numbers. It will become official in about a year when it is included in the standards of the American Society for Testing Materials.

The way was paved for this overdue decision in two meetings held recently: The A.P.I. midyear refining meeting in Montreal and a session June 22 of the A.S.T.M. Committee D-2 on Petroleum Products and Lubricants.

Good, bad points . . . The Wiese scale will give refiners more octane numbers to talk about above 100.

It is based on the Army-Navy performance number and will give a fairly good correlation of octane numbers with engine performance. Octane numbers on the new scale will also reflect the costs of making octanes more closely than does the extension of the research scale.

The accepted scale has one big drawback. A break will exist at the 100 level between the conventional scale below that point and the Wiese scale above it. This is something the industry will have to learn to live with. Actually, for blending operations, refiners will use performance numbers above and below 100, as they have been doing.

Some proponents of using Army-Navy performance numbers, extension of the conventional research curve, and various other modifications stuck to their guns. But while the committee's recommendations were not unanimous, those who opposed it preferred it to no decision at all. The period of uncertainty is now over.

In announcing the decision, the committee made the following points:

. . . There will be no revision to the octane scale below 100. It will continue to be based on isooctane and normal heptane as reference fuel.

. . . The increments above 100 will be termed "octane numbers."

. . . Reference fuels above 100 will contain isooctane and tetraethyl lead in quantities up to 6 ml. per gallon.

. . . The point on the scale representing isooctane plus 6 ml. of TEL will be defined as 120.3 octane number. This is the Wiese scale charted here, devised and recommended by Warren M. Wiese of the General Motors research staff.

. . . These reference fuels will have the same value for both motor and research methods for determination of octane number.

Further information on reference fuels will be made available by October 1 through the secretary of A.S.T.M.'s D-2 committee, W. T. Gunn, 50 West 50th St., New York, N. Y.

The formula . . . The Wiese formula for numbers above 100 is:

$$ON = 100 + \frac{PN-100}{3}$$

This scale retains the advantages of the AN-PN scale but makes numbers larger. It modifies but does not eliminate the break at 100, as shown by the chart.

The Wiese scale won out over three other leading candidates. They were AN-PN scale above 100, AN-PN or modifications from 80 or 90 RON on up, and the extension of RON through 100.

The automotive companies wanted the extended scale to show a relationship to knock-limited compression ratio and engine performance. Two companies preferred switching to AN-PN both above and below 100. A third manufacturer favored the scales adopted—RON below 100 and the Wiese scale above that point.

Refiners wanted a scale whose numbers reflect manufacturing costs. The Wiese scale fitted the bill for showing rapidly rising costs per octane number per barrel at progressively higher quality levels. *The Oil and Gas Journal, June 4, page 68).*

Pipeline to Expand

South Saskatchewan deal wins over Royal's project

REGINA.—Work will start in mid-July on a 59-mile crude-line extension from Cantuar to Dollard fields. Completion is expected by late September.

It will be constructed by South Saskatchewan Pipe Line Co., which won approval of the project at a recent public hearing of the Oil and Gas Conservation Board.

The $2,900,000 line will hook up at Cantuar with the company's main system, a 156-mile, 16-in. line to Regina *(The Oil and Gas Journal, June 25, page 62).* The main system connects here with the Interprovincial Pipeline.

Bone Creek, Premier, Gull Lake, and Instow fields will also be served by the new extension, which will have an initial throughput of 10,000 bbl. daily. This would jump to 17,000 bbl. daily within 2 years.

South Saskatchewan is backed 50 per cent by Mobil Oil of Canada, Ltd., 30 per cent by Woodley Canadian Oil, Ltd., and 20 per cent by Southern Production Co., Inc.

Royal Pipe Lines Co., Ltd., opposed South Saskatchewan's application Royal is a recently formed company backed by D. D. Feldman of Dallas.

State Regulation Looms

Colorado Commission prepares further action to harness Rangely field production; operators disagree on method

DENVER.—State control of production from Colorado's Rangely field, the state's biggest, is a step nearer reality.

Warwick Downing, chairman of the Colorado Oil and Gas Conservation Commission, ordered his staff to draw up regulations governing production after a day-long hearing failed to solve the problem of excessive gas flaring in the field.

Downing said major producers generally agree control is needed, but have reached no agreement on the specific type of control.

Ceilings proposed . . . Herman Kaveler, Tulsa, engineering consultant to The California Co., declared at the hearing that the field's 476 wells each should be limited to production of 200 to 250 bbl. of oil daily. Also, he said, there should be a ceiling of 600 cu. ft. of natural gas per barrel of oil produced.

Kaveler estimated his proposal would allow production of 74,000 bbl. daily along with 141,000,000 cu. ft. of gas, all but 28,000,000 cu. ft. of which would be reinjected into the producing formation.

Reinjection of gas and flaring have been big issues in operation of the field ever since the Colorado Supreme Court ruled in May 1955 that the commission lacked authority to order reinjection in the Rangely field.

Edward Knowles, Denver lawyer representing a joint field interest held by The Texas Co. and Union Pacific Railroad, said that no well should be allowed to produce more than 300 bbl. daily.

His position was supported by Jack Tarner of Bartlesville, Okla., representing Phillips Petroleum Co. Tarner, however, argued against required reinjection of gas and contended that operators should be permitted to flare as much as 84,000,000 cu. ft. daily.

The commission was advised that during April the field produced 78,000 bbl. of oil and during May 83,000 bbl. Natural-gas production during April reached 147,000,000 cu. ft., of which almost 33,000,000 cu. ft. was flared.

Reason for hearing . . . The hearing was called by Downing after he charged that the Rangely operators had refused to cooperate among themselves and with the commission on conservation measures.

He appealed to The California Co. to agree to unitization of the field, already endorsed by other operators.

Kaveler estimated that up to 2,000,000,000 bbl. of oil remain in the field, and that 1,250,000,000 bbl. could be recovered with proper conservation practices.

Saskatchewan Tempo Rising

REGINA.—Spending for petroleum development in Saskatchewan, Canada's second largest oil province, totaled $277,000,000 from 1951 to 1956.

This was revealed last week by the natural gas branch of the Provincial Minerals Department. During the same period, the government earned $12,152,155 from oil-industry services, including $7,767,800 from rentals, $3,654,400 from land sales, and $730,252 from royalties.

The department also disclosed that crude production increased from 1,247,395 bbl. in 1951 to 11,317,168 bbl. in 1955. These statistics illustrate the industry's growth in the province:

	1951	1955
Wells drilled	124	919
New oil wells	52	564
New gas wells	8	12
Dry holes	64	333
Oil producers	237	1,655
Gas producers	60	130
Wellhead oil value	$1.18	$1.55
Refinery capacity	34,150	67,800

Alberta Sets Allowable

CALGARY.—Alberta's crude allowable for July has been set at 406,365 bbl. daily, with provisions for an increase to 444,174 bbl. daily.

The higher figure will apply if Shell Oil Co. goes through with a conditional nomination for 38,000 bbl. daily for its Anacortes, Wash., refinery. Shell would draw that amount if the 13-week-old strike there is settled.

The high allowable reflects record-setting nominations for Alberta crude *(The Oil and Gas Journal, July 2, page 74)*.

Heaviest draw will be from Pembina field, where the allowable has been set at 92,828 bbl. daily. If the Anacortes dispute is cleared up, this would be boosted to 100,000 bbl. daily.

On this same basis, Redwater will produce 77,862 or 87,073 bbl. daily, and Leduc-Woodbend, 58,270 or 61,722 bbl. daily.

Processing BRIEFS

ANACORTES, Wash. - W. B. Logan, Pacific coast refining manager for The Texas Co., has revealed that the company is examing titles of property optioned in the Anacortes area for possible use as a new refinery site. No information on the size of the proposed plant is available, but plans may firm up before the end of the year.

NEW YORK.—Universal Oil Products Co. last week reduced the price of Platforming catalysts 25 cents a pound. The same reduction will apply to recovery of spent catalyst.

BOSTON. — Badger Manufacturing Co., Cambridge, has the contract to build a 7,000-bbl. Powerformer at Esso Standard Oil Co.'s Everett, Mass., refinery. The unit is part of a program to increase Esso's production of high-octane motor fuel. The company is now marketing a super premium rated above 100 research octane.

WHITING, Ind.—Standard Oil Co. (Ind.) is readying a site for a second Ultraformer at its 220,000-bbl. refinery here. The unit will have a capacity of 21,000 bbl. Work will start about the middle of the month, just as finishing touches are applied to the first Ultraformer, a 14,000-bbl. unit started last fall.

It was launched as a crash program to replace a damaged fluid hydroformer. Ralph M. Parsons Co. of Los Angeles is the contractor on both units. The firm recently built a 14,000-bbl. Ultraformer at Indiana Standard's Sugar Creek, Mo., refinery.

SAN FRANCISCO - Shell Oil Co. has started preliminary work on a $500,000 expansion program at its Martinez refinery's asphalt manufacturing facility. Plans call for construction of a 1,500 bbl. asphalt plant to include the latest in instrumentation and blending equipment. Completion is scheduled in March, 1957.

CALGARY. — A $30 - million synthetic-rubber plant is planned for Alberta, Carl O. Nickle, oil man and member of the Canadian Parliament, reports. Nickle said the plant might be built at Red Deer midway between Calgary and Edmonton. Nickle said major industrial development could be expected in the Pincher Creek, Medicine Hat, Calgary, and Edmonton areas as a result of the construction of Trans-Canada natural-gas pipeline. He predicted development would amount to $120 million in 5 or 6 years.

Cuban Strike Promising

● Discovery is island's first deep high-gravity oil on a structure offering hope for good sustained production

CUBA'S most significant oil strike appears to have been made 4½ miles southwest of Jatibonico field, whose discovery 2 years ago led to the current exploration play.

Cuban-American Drilling & Exploration Co., Dallas, tested an estimated 25 bbl. an hour of 35°-gravity oil from a limestone zone at 7,107-37 ft. at its 1 Catalina. The discovery of the first high-gravity oil on a structure in Cuba and at such depth elated operators on the Caribbean island.

Cuba's first producer in the Lower Cretaceous also came in last week in Pinar del Rio Province, on the western tip of the island.

Cuban-American strike . . . The Cuban-American well is located 2 miles south of the town of Jatibonico in Camaguey Province in the central basin.

The well was drilled on a large anticlinal feature picked out by seismic operations on Cuban American's Scorpio No. 2 concession containing about 75,000 acres. The company has a 50 per cent interest in any well completed on this concession. Trans Cuba Oil Co. and Cuban Venezuelan Oil Voting Trust each have a 25 per cent interest.

The flow of oil from the 1 Catalina came during a 35-minute drill-stem test of the 30-ft. limestone interval from 7,107-37 ft. The test was made with ¼-in. top and bottom-hole chokes and with 570 ft. of water cushion.

Maximum surface pressure during the test was 57 psi. Shut-in surface pressure after 15 minutes was 100 psi. and climbing.

Operator pulled 13 stands of drill pipe and unloaded the water cushion and 900 ft. of oil. Reversed out of the drill string was 535 ft. of oil, 35 ft. of oil and gas-cut mud, and no water.

Initial bottom-hole flowing pressure was 1,000 psi. Bottom-hole flowing pressure had climbed at the end of the test to 3,400 psi.

Late last week, Cuban American was pulling another 20-ft. core in the limestone down to 7,157 ft. The company had planned to take the well considerably below its present depth. One of its officials, E. H. Gunter, told the Journal last week, however, that the company most likely would complete the well in the limestone after investigating the pay further.

Gas and pressure from that zone would make it risky to try to carry the hole deeper without running a protective string of casing, he said. And the company feels it cannot safely go to a smaller hole.

Its sixth try . . . The 1 Catalina, if completed successfully, will be Cuban-American's first strike in six attempts.

The company spudded in its first Cuban test, the 1 Adelaide, in September 1954 about 8 miles northeast of Jatibonico field which accounts for most of Cuba's 1,600-bbl. daily output. It has drilled four others since, all in the central basin.

The company tested numerous oil shows in the wells, but all were noncommercial. Cuban-American developed a strong flow of gas at 2,708 to 2,738 ft. at its 1 Cristales 9 miles east of Jatibonico field. Efforts to increase pressure and flow by more perforating resulted in recovery of water, believed due to a faulty cement job.

A 1,000-ft. offset from this well, the 1-A Christales, is waiting on a rig.

The 75,000 acres in the Scorpio No. 2 concession is part of more than a million concession acres held by Cuban-American and its associates. Nearly all of the area is in the central basin.

Pinar del Rio well . . . This test, like the 1 Catalina, was drilled by C. J. Simpson Drilling Co. of Cuba.

The 1 Pacheco, located 4 miles northwest of Cayajaneos, gives Pinar del Rio its first production.

Ten barrels daily was recovered last week by swabbing, which followed acidizing of the hole from 1,300 to 1,450 ft. When tubing was pulled a casing swab recovered 30 bbl. Immediately after acidizing, shut-in pressure remained at 600 psi. for 2 hours.

Owners of the well are Cuban Canadian Petroleum Co. and Pacheco Petroleum Co., each with 25 per cent, and C. J. Simpson, 50 per cent.

Drilling Planned

Sites being selected for tests slated in Nicaragua

DRILLING is expected to start within 2 months in Nicaragua, according to reports from Managua.

The drilling is expected to take place on concessions controlled jointly by Joseph K. Coney, San Francisco tanker operator, and Miguel d'Escoto, Nicaraguan ambassador to Italy. Granted in June 1955, the concessions extend to December 31, 1958, at which time the unexplored and unclaimed areas must be given up.

The exploration rights extend along both the Pacific and Caribbean coasts of Nicaragua, extending about 7 miles inland to 1 mile at sea for the entire lengths of the coasts. They cover 15 million acres.

H. Wayne Holman, oil consultant, has been retained by the concession holders to select drilling sites. He is reported at present studying aerial surveys made of the concessions areas. Holman was connected with the Gulf Oil Co. as consultant when they made preliminary surveys in Nicaragua just before the war.

Several major oil companies have indicated interest in obtaining concessions in Nicaragua. However, no further concessions will be granted until a new oil law, now under study, is passed by the Nicaraguan Congress.

With three tracts unsold . . .

. . . Venezuela Seeks Bids

OFFICIAL action on the eight successful bids for almost 200,000 acres of Lake Maracaibo acreage may not come until Venezuela gets offers for the three remaining blocks in its first concession offering in more than 11 years.

The government last week was making an effort to obtain additional bids on the three 10,000 hectare (about 25,000 acres) blocks not awarded in the original sale. The government has made no announcement of the successful bids which were reported to total almost $200 million *(The Oil and Gas Journal July 2, page 77).*

In the absence of an official announcement it was still not clear last week whether the bidders shunned the three blocks of acreage or if the bids have been rejected as unsatisfactory by the government. They are the three most distant from lake production.

According to all reports from Caracas, a four-company combine new to Venezuela offered more than $1,100 an acre or a total of more than $28 million for one block in the bids which were made June 9. The four are Signal Oil & Gas Co., Hancock Oil Co., Sohio Petroleum Co, and Pure Oil Co. Sohio will be the operator.

Four of the blocks went to Mene Grande Oil Co., (Gulf), one each to Cia. Shell de Venezuela, Creole Petroleum Corp. (Jersey Standard), and a two-company group of Sun Oil Co. and Atlantic Refining Co.

None of the companies has confirmed the report of successful bids, but all are believed to have been informed orally by the ministry of mines and hydrocarbons that they will receive the acreage. The successful bids have to be formally solicited under terms of Venezuela's petroleum law.

Persian Gulf Deep Test Ready

THE British-French Company which has the exploratory concession for Persian Gulf waters off the Trucial Coast of Arabia plans to drill its first well 80 miles off the Arabian mainland in 50 ft. of water.

The island of Das, 60 miles from the coast of Abu Dhabi, is now being prepared as a base camp for the operation. The site for the company's first deep test is 20 miles off the island.

British Petroleum Co., Ltd., owns two-thirds of the operating company, Abu Dhabi Marine Areas, Ltd. The other one-third is owned by Cie. Francaise Des Petroles.

The two companies have spent the past several years in seismic work and geological and geophysical studies of the floor of the Persian Gulf in that area *(The Oil and Gas Journal, July 2, page 60).*

The first deep test will be drilled with a special DeLong barge, now being built in Dusseldorf, Germany. It is capable of drilling a 15,000-ft. well.

The barge is similar to those used in offshore drilling operations in the Gulf Coast areas of the United States, but has some new design features. It will be 190 ft. long, 106 ft. wide, and equipped with a jack mechanism to raise its caisson legs from the seabed once the well is completed.

The drilling barge and the first well are expected to cost about $14 million.

The base on the island of Das will be equipped to service the barge during the drilling operation. In addition to harbor facilities, the island will be equipped with an air strip for the use of helicopters operating between the base and the barge.

The Abu Dhabi well will be the third drilled in the southwestern region of the Persian Gulf. Shell Oil Qatar, Ltd, drilled one well 5 miles off the coast of Qatar last year. It was abandoned at 6,700 ft. The platform used for that well is now drilling a second test about 50 miles east of Doha.

Wildcat Hits in Germany

A wildcat discovery has been made north of Hannover, Germany, by Deutsche Erdoel, A. G. The location is 5 miles southwest of Gifhorn in the easterly region of an east-west string of oil fields.

Leiferde 1 tested at the rate of 370 bbl. daily through a 0.16-in. choke from medium-grained sandstone at 2,700 to 2,736 ft. The crude was 34° gravity. The structure was located by seismic surveys.

Colon to Get Refinery

Colon, at the Atlantic entrance to the Panama Canal, has been selected as the site for a $33-million refinery planned by Petrochemical Co. The site must be approved by the Panamanian Government. The refinery is one of two planned in Panama.

The announcement was made through Herbert O. Jason, executive vice president of the New York consultant firm of Boni, Watkins, Jason & Co., which has been retained by the refinery company.

Petrochemical Co. is controlled by two individuals, Eugene du Pont III and John Shaheen.

Yemen Deal Argued

U. S. company's concession disputed by German firm

THE West German firm carrying on exploration work in Yemen is disputing the concession recently granted an American firm.

C. Deilmann, Bergbau, G.m.b.H., Bentheim, which signed an exploration contract in 1953, said it had an option on territory granted late last year to Yemen Development Corp. *(The Oil and Gas Journal, November 28, 1955, page 66).*

Deilmann plans to introduce arbitration proceedings. The firm also will discontinue its exploration work in the mountainous Red Sea country.

The joint development contract granted Deilmann a 5-year exploration permit. If commercial production is found within that time, the permit is to become a 20-year exploitation permit.

The government has a 75 per cent interest in the operation, paying three-fourths of the costs and obtaining three-fourths of any profit.

U. S. deal . . . At the time Yemen Development received its concession last year, officials said there was no conflict with the Deilmann contract.

The American firm, owned by George E. Allen and other interests, obtained a 30-year concession over the northeastern two-thirds of Yemen, about 40,000 sq. miles. The agreement can be voided if there is no discovery within 6 years. In case of commercial production, the customary 50-50 profit split will apply.

Deilmann's move followed several months of unsuccessful negotiations with Yemen. Exploration work had advanced to the point where a location for a wildcat was staked. Some drilling equipment has arrived in the country, and a deep test was due to begin when an approach road was completed.

Another dispute . . . The Yemen Government is on the other side of the fence in another concession dispute.

The government is protesting a concession over the Kamaran Islands in the Red Sea, granted to British Petroleum Co., Ltd., by Aden protectorate.

SIGNING THE PAPERS which gave San Jose Oil Co. 2,500,000 acres in exploration concessions on three islands in the Philippine Group are, left to right, Chester A. Baird, president of San Jose Oil; Arturo Santos, an attorney; Juan G. Rodriguez, Philippine secretary of agriculture and natural resources; Elpidio Vera, Philippine Government engineer; and Benjamin Gozon, Director of Mines for the Philippines.

Philippine Deal Signed

San Jose Oil, third American firm, gets concessions on islands; aerial survey scheduled to start immediately

A THIRD American-controlled company, San Jose Oil Co., Inc., last week entered the Philippine Islands exploration play.

San Jose Oil was granted 13 separate concessions covering about 2,500,000 acres on the islands of Luzon, Panay, and Mindanao. Final papers were signed last week in Manila by Juan G. Rodriquez, Philippine Secretary of Agriculture and Natural Resources.

The majority interest in San Jose Oil is owned jointly by Pantepec Oil Co. and Pancoastal Petroleum Co., both Panamanian firms controlled by the J. W. Buckley interests of New York.

President of San Jose Oil is Chester A. Baird, former manager of foreign exploration for Gulf Oil Corp. Baird will have direct supervision over four geological parties at work in the Philippines. The company president revealed last week that he has signed a contract with Aero Service Corp., Philadelphia, for an aerial magnetometer survey of the new concession areas. The survey will begin immediately.

The largest single block of acreage obtained by San Jose Oil is on the island of Luzon but it is south and west of the Cagayan Valley where three other companies are concentrating their exploration effort. This large tract of acreage surrounds a smaller block which is held jointly by San Jose and Philippine Oil Developement Co. (Podco).

Podco's test . . . The only well now under way in the Philippines is being drilled by Podco in the Cagayan Valley area where both Caltex companies and Standard Vacuum Oil Co., also have acreage.

The Podco test was drilling below 11,000 ft. last week after finding a show of oil, regarded as noncommercial, at 9,026 ft. *(The Oil and Gas Journal, May 28, page 103).* The well is being drilled by Kern Drilling International Co. at a location 25 miles off the northeast coast of Luzon in the Province of Isabella

Other concessions . . . Podco, Stanvac, and the Caltex companies have the entire Cagayan Valley region of northern Luzon blanketed with closely interlocking concessions.

The Philippine company, headed by Andres Soriano, and Stanvac made overlapping applications for concessions in the area. As a result the actual granting of the concessions was held up until the dispute could be settled. Last year the area was divided into three sections with each company taking one area exclusively. The third was to be shared under a cross-option agreement *(The Oil and Gas Journal, July 1, 1955, page 104).*

The areas shown on the accompanying map as Caltex concessions are held jointly by California Asiatic Oil Co. and Texaco Overseas Petroleum Co. These subsidiaries of The Texas Co. and Standard Oil Co. of California also have cross-option agreements with Podco under which they can obtain a half interest in Podco acreage by each supplying 25 per cent of development costs after any discovery is made. The two American companies each have a one-half undivided interest in 1,235,000 acres in seven separate concessions.

Stanvac has eight exploration concessions totalling 959,500 acres in northern Luzon.

Three Philippine companies, Luzon Stevedoring Co., Acoje Mining Co., and Philex Mining Co., all have smaller blocks of concessions scattered through the central islands of the Philippine group.

Costa Rican Well Tested

The Union Oil Co. subsidiary drilling in Costa Rica, Cia. Petrolera de Costa Rica, has ceased drilling Cocolas 1 well near the border with Panama and is testing the well for flow, pressure, and quality of the oil shows located below 5,400 ft.

An official of the company said that tests to date "are not too encouraging" but that the company's plans to drill another well, Cocolas 2, about 1 km. from the present well, are unchanged.

It is also understood that Union will drill at least one well over the border in Panama in accordance with the terms of its present concessions it has with the Panamanian Government.

Lebanon, I.P.C. Tangle

Iraq Petroleum threatens to quit moving crude through Lebanon after country claims ownership of holdings

IRAQ PETROLEUM CO., LTD., warned last week it may completely bypass Lebanon with its pipeline system unless the country and the company can agree on pipeline tolls.

The warning came after a Lebanese statement that has been subject to several different interpretations, ranging from seizure of I.P.C. property to merely a bargaining threat.

"In the absence of any agreement," I.P.C. said in London, "The company will be obliged to consider alternative means of shipping additional Iraq oil to the Mediterranean."

The Lebanese announcement declared Lebanon now regards all Iraq Petroleum installations within the country as Lebanese property.

The immediate reaction to the announcement in London ranged from cautious puzzlement on the part of I.P.C. to outrage in the press as British papers interpreted the move as a threat to Britain's oil supplies. I. P. C. said only that it was "quite unable to interpret Lebanon's statement."

In the United States the move was interpreted as merely the last bargaining maneuver on the part of the government that wants more revenue in pipeline-tariff tolls for the oil shipped across its borders. U. S. observers pointed out that the "seizure" announcement is not backed up by any legislative action of the Lebanese Parliament. It was merely a statement by Saeb Salem, Lebanese Minister of State.

Interest in the action is widespread because of the divergent ownership of I. P. C. and its 711,000 bbl. daily production. Near East Development Co. (Jersey Standard and Socony), British Petroleum Co., Ltd., Royal Dutch-Shell, and Cie. Francaise Des Petroles each own 23.75 per cent of I. P. C. The remaining 5 per cent is owned by the Gulbenkian estate.

What's involved . . . While the minister of state's announcement did not specify just what installations the Lebanese now consider to be their property, they presumably include both pipelines and the I. P. C. refinery at Tripoli.

About 20 miles of 12-in. and 16-in. pipelines from Iraq's oil fields cross Lebanese territory and terminate at Tripoli. The refinery at the port city has a daily capacity of 11,550 bbl.

The income Lebanon should receive for allowing Iraq oil to be transported through those 20 miles of pipeline is the key to the entire situation. Lebanon now gets about $1,100,000 a year from the flow of this oil. It wants much more. The talks to settle the point to the satisfaction of both Lebanon and the oil company broke down completely last January.

Lebanon refuses to accept the ton-mile formula on which I. P. C. negotiated a new agreement with Syria. Lebanon demands just as much revenue as Syria, but I. P. C. rejects this as unrealistic. Syria has about 263 miles of pipeline within its borders. Lebanon has only 20. The new Syrian agreement boosted that country's I. P. C. revenue to more than $18 million a year with an added $23,800,000 tossed in for back claims.

Expansion stymied . . . The breakdown of negotiations between Lebanon and I. P. C. and now the property claim are roadblocks to expansion of the pipeline system.

I. P. C. wants to build another 24-in. line from Homs, Syria, to Tripoli. It would carry another 180,000 bbl. daily of crude across Lebanon's territory. At the same time, I. P. C. would expand the Tripoli refinery to about 13,700 bbl. daily.

If Lebanon does follow through with a legal expropriation of the refinery and pipelines, the move will not halt the flow of Iraq crude to the Eastern Mediterranean. I. P. C. will still have a 30-in. line to Banias on the Syrian coast without touching Lebanese soil. This line moved more than twice the volume of crude that the two lines across Lebanon transport.

BP Renames Subsidiaries

One of the most familiar names in the industry, dating back to 1914, has disappeared in a move that sees the renaming of eight subsidiaries of British Petroleum Co., Ltd., in order to identify them more closely with the BP group symbol.

D'Arcy Exploration Co., Ltd., is now BP Exploration Co., Ltd. The change follows by a year and a half the renaming of the parent company from Anglo-Iranian Oil Co., Ltd.

Other changes are: British Tanker Co., Ltd., to BP Tanker Co., Ltd.; Aden Petroleum Refinery, Ltd., to BP Refinery (Aden), Ltd.; Australasian Petroleum Refinery, Ltd., to BP Refinery (Kwinana), Ltd.; D'Arcy Kuwait Co., Ltd., to BP (Kuwait), Ltd.; Grangemouth Petroleum Refinery, Ltd., to BP Refinery (Grangemouth), Ltd.; Kent Oil Refinery, Ltd., to BP Refinery (Kent), Ltd.; and National Oil Refineries, Ltd., to BP Refinery (Llandarcy), Ltd.

Italian Bloom Fades

Encroachment forces Gulf to shut in two Cigno wells

THE Gulf Oil Corp. subsidiary testing two wells on the Italian mainland has shut-in production because of salt water encroachment.

The wells, Cigno 1 and 2, are located near the Adriatic Coast about 100 miles east of Rome. They were discoveries made last year by Petrosud, S.A., jointly owned by Gulf and Montecatini Mining & Chemical Co. *(The Oil and Gas Journal, September 26, 1955, page 142).*

Petrosud was producing the wells for test purposes under a special permit. The Italian Government has refused to grant an exploitation concession on the license.

The poor showing of the wells may throw a different light on the controversy surrounding the terms of a proposed new petroleum law *(The Oil and Gas Journal, April 9, page 85).* If the Cigno wells fail to live up to their promise, the tests could illustrate that oil exploration in Italy may be a more costly and risky business than previously believed in some quarters.

Cigno 1 at first tested 2,000 bbl. daily of 34°-gravity crude at 2,300 ft. Cigno 2 offset 1,690 ft. to the north was completed below 2,600 ft. and tested as well as the discovery.

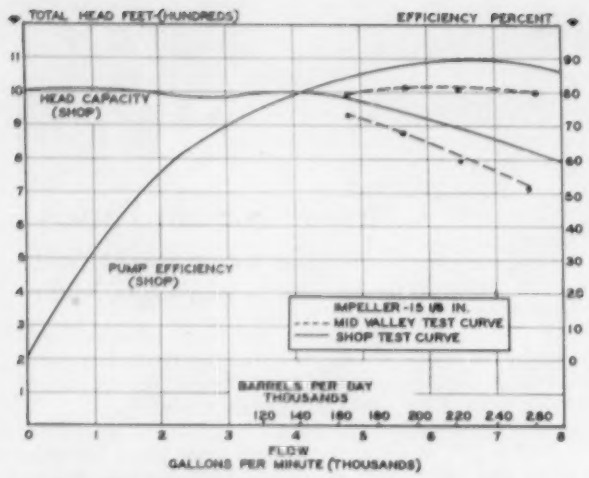
Four other wells drilled on the Abruzzi license indicate that the structure is irregular. Cigno 6 is currently at 2,800 ft.

Puerto Rico Gives Concession

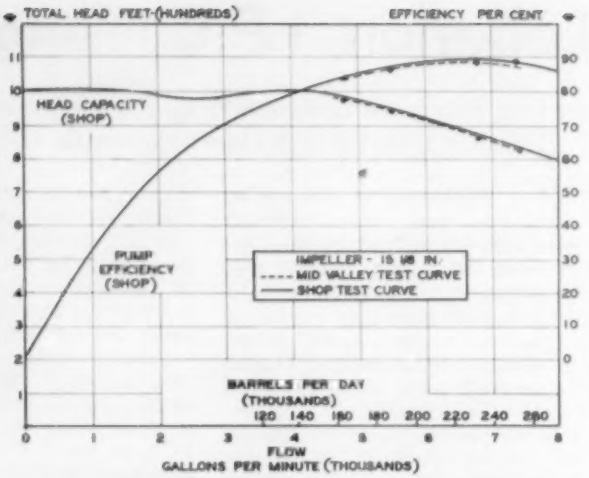
An oil and gas concession covering more than 1,000 sq. miles in Puerto Rico has been awarded Frank H. Crerie, Houston investment banker, and William S. Wallis, Toronto consultant.

The grant gives Crerie and Wallis exclusive exploration rights for oil and natural gas on two large strips of land. One lies along the northern coast of the island and the other on the southern coast. The concession includes adjoining land under the Atlantic Ocean and the Caribbean Sea.

Terms provide that drilling must start within 6 months. Crerie said the first test is to be drilled near Ponce on the southern coast. Plans call for establishment of a publicly held company to help explore the area.



TESTS USING TORQUE PICKUP on this pump showed efficiency and head well below rated values. Fig. 1.



AFTER DAMAGED IMPELLER REPLACED, tests were repeated, showing pump performance back to manufacturer's ratings. Fig. 2.

New torque pickup allows . . .

Direct Efficiency Tests on Pipeline Pumps

Direct measurement of input torque to a pump is possible with the strain-gage torque coupling described here. This device, used in a detailed testing procedure, allows onblock efficiency tests of main-line pumps and drivers.

by Robert G. Deering
Associate Pipeline Editor

A NEW torque-measuring device and a complete testing procedure are being used by Mid-Valley Pipeline Co. to test efficiency of centrifugal pumps and their drivers. A special coupling with built-in strain gages is connected between pump and driver for direct reading of input torque to the pump. Detailed measurements also are made of all hydraulic quantities for calculation of output horsepower and pump efficiency.

The method is used also for efficiency tests on engines and motors. In effect, it allows field tests on pipeline equipment which closely approximate shop tests by the manufacturer. The field tests are controlled closely and are of comparable accuracy to shop tests. Perhaps better, they are made during actual operation and reflect normal operating conditions.

The engines and motors being tested are in the range of 1,200 to 1,700 hp. Pumps are all single-stage centrifugals with ratings up to 6,850 g.p.m. at head of 800 ft. In general, these pumps are 12 by 12 by 16-in. double-volute, double-suction pumps.

Even though tests are closely controlled and give accurate results, the primary purpose isn't to check against a manufacturer's shop tests or his guaranteed ratings. These tests are maintenance tools. First, they point up inefficient pump units that need immediate repair, or adjustment. Then they establish a base line so that future tests will show any decline in performance.

Best suited . . . Practically, the method is best suited for testing engine-driven units. Electric-motor efficiencies are accurately determined by manufacturer's tests and remain quite constant over long periods. Thus, by measuring input power to the motor, output hydraulic horsepower of the pump, and considering efficiency of the motor, a good figure for pump efficiency can be determined.

But, with engines as drivers, many other possible factors are involved. Low over-all efficiency of an engine-pump unit may be caused by either engine, pump, speed increaser, or all three. Use of the torque measurement between pump and driver allows closer pin pointing of any trouble.

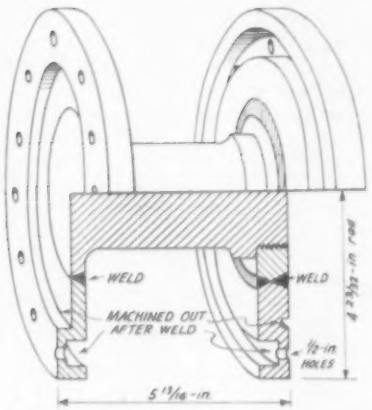
With previous tests, efficiency of complete engine-pump units could, of course, be determined. But the efficiency of either engine, speed increaser, or pump could not be determined individually. Mid-Valley uses manufacturer's curves for speed-increaser efficiency. But performance of the pump is found accurately and without assumptions.

Results to date . . . The test method described here has been used by Mid-Valley for over 2 years now. During this period, it has been quite successful in spotlighting pump and engine units needing maintenance. One case of trouble was corrected which paid for the torque-measuring equipment. This was on a unit which testing showed to be running about 5 per cent below rated efficiency. Normal maintenance procedures failed to reveal anything wrong. But dismantling of the pump showed that two opposing impeller blades were damaged.

At the time, the unit was handling about 4,800 bbl. per hour at a differen-

PIPELINING

"One case of trouble was corrected which paid for the equipment"



DESIGN of blank torque spool before mounting of strain gages and slip rings. Fig. 3.

tial head of 930 ft. so the lower efficiency meant many dollars in wasted horsepower.

Changing out this impeller raised the pump efficiency so that it approached the manufacturer's shop test curve. Figs. 1 and 2 show field curves made before and after replacement of the impeller.

New Equipment Used

Heart of the testing method is the equipment for measuring torque. This consists of a tool-steel flanged coupling on which are mounted strain gages and slip rings, a silvered brush assembly with stand, a four-conductor cable, and an instrument containing batteries and a meter.

The spool replaces the conventional coupling between pump and driver during a test. The torque meter is calibrated in inch-pounds and has a scale range of 0 to 30,000 in.-lb., i.e., it will indicate about 1,700 hp. at 3,600 r.p.m.

The equipment was developed to Mid-Valley's specifications by Baldwin-Lima-Hamilton Corp. Mid-Valley designed the blank spool, shown in Fig. 3, had it machined, then sent it to Baldwin-Lima-Hamilton for mounting of strain gages, slip rings, and calibration. The spool and meter were calibrated to an accuracy of 1/10 per cent of full scale. It has a sensitivity of 1/30 per cent full scale, or about 10 in.-lb.

The spool is of an unusual design. The outside ring of one end flange for the bolt circle is mild steel. The flange and the hub on the unthreaded end were turned from tool-steel bar stock. A ring of tool steel was welded to the mild-steel flange on the threaded end.

The flange on the threaded end is made up of a mild-steel ring and another ring of tool steel. The two were welded, then threaded for fitting to the shaft. Once made up tight, threads were peened. The spool is always installed to tighten during operation.

Blank spool . . . Fig. 3 shows a drawing of the blank spool before slip rings and strain gages were mounted. Its length is the same as that of the conventional floating-end coupling normally used between pump and driver in most of Mid-Valley stations. Some stations have units with a longer coupling so a spacer was designed to fill in the gap.

The tool-steel shaft was made only about 2 in. in diameter so the peripheral speed, and hence wear on slip rings and brushes, could be held to a minimum. The small diameter also allows greater twist under load, making for easier measurement by the strain gages. The shafts which this coupling joins are 4 in. in diameter.

EXAMPLE

How torque can be measured by strain gages

ASSUME a shaft with four equi-resistant strain gages bonded to surface so the projection of the gage configuration will form a square under no load conditions. Fig. A.

Under torsional load, Fig. B, the surface fibers on the shaft twist through an angle, θ. As long as the proportional limit of the shaft material is not exceeded, the angle $\theta = TL/EJ$, where:[1] T = torque in inch-pounds; L = length of shaft in inches; E = modulus of shear, psi.; and J is the moment of inertia in (inches)^4.

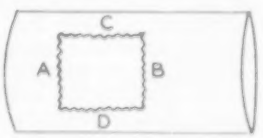


Fig. A.

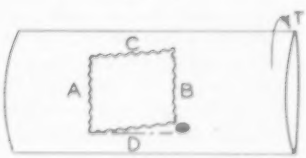


Fig. B.

This torsional load also moves the strain gages C and D which are aligned axially. Gages A and B are under no strain since the diameter of the shaft remains constant. But gages C and D are strained in proportion to the angle θ. If the original length of the gages is x, the change in length, $\Delta x = x \sec \theta - x$.

Since the resistance of the gage is proportional to length, the change in resistance is proportional to Δx and a function of θ. Therefore, $R = (f)\,\theta = (f)\,(TL/EJ)$ or $R = (f)\,KT$ where K is a constant.

If the four strain gages are connected in a bridge circuit, there will be no current flow in the bridge-detector circuit under no-load condition since the strain gage resistances are equal. With torque applied, gages C and D change resistance and the resultant current flow is a function of torque. With the bridge connected as shown below, Figs. C and D, the conditions for balance are that resistances AB = CD. Under load, this will not hold, i.e., AB≠CD and current will flow through the detector circuit.

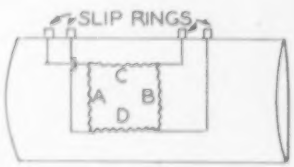
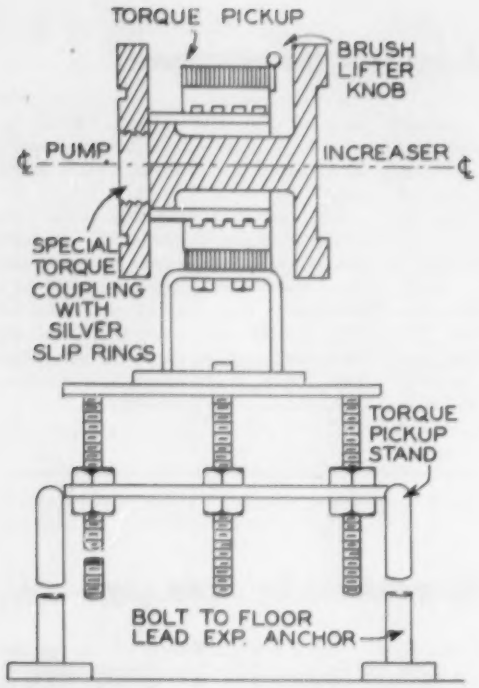
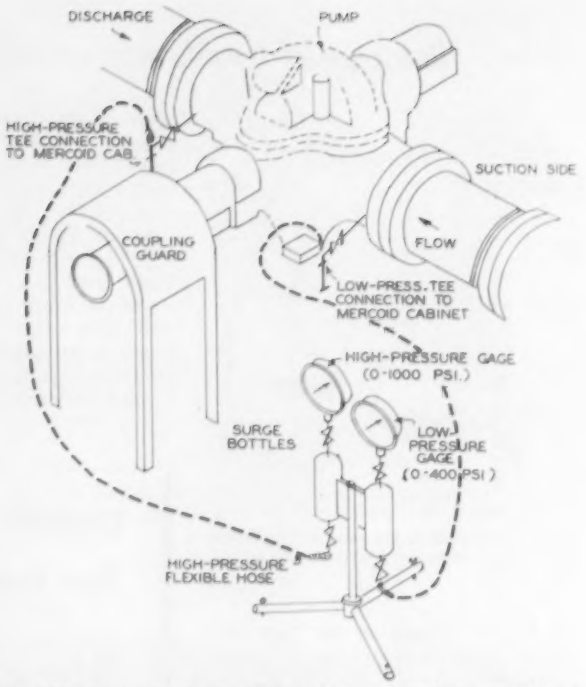


Fig. C.

Fig. D.



BRUSH HOLDER and stand shown connected to slip rings on torque coupling. Fig. 4.



GAGES for measuring pump differential are mounted on small stand, protected with surge bottles. Fig. 6.

The strain gages on the spool are arranged as a bridge; two resistors aligned with the shaft axis, and the other two perpendicular. Under no load, the projection of this configuration would be a square. Under load, the perpendicular members remain so but the axial resistors assume a skewed position. The angle of skew is identical to the angle of twist of the shaft since the resistors are bonded to the shaft. This increases length, hence resistance, of two arms of the bridge and causes unbalance. The unbalance current through the detector circuit of the bridge is a function of torque on the shaft. The instrument scale is calibrated to read directly in inch-pounds of torque.

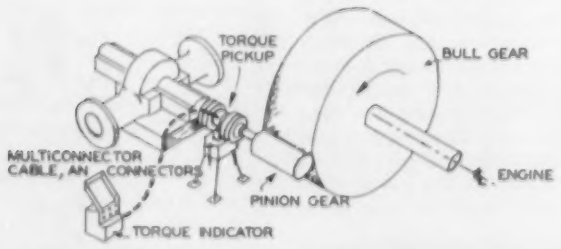
The brush holder used with the torque coupling has a lifting assembly so that brushes need be let down only when readings are being made. This saves wear on brushes and slip rings.

The coupling itself has four slip rings, each of which is contacted by four brushes. Brass rings and the four paralleled brushes keep contact resistance to a minimum. The number of brushes also gives a margin of safety against damage in the field, i.e., a broken lead or a single bad brush won't put the instrument out of commission.

Only one difficulty has been found in using the torque coupling. That is, in setting the brushes when the unit is dead so they will ride true on the slip rings with the unit running. Allowable end play in Mid-Valley's engine-driven units is about ⅛ in. and the dead position of a shaft is seldom the same as its run position. Also, end play varies with each unit. Since slip rings are only ⅛ in. wide and there is no provision for axial adjustment of brushes after initial setting, a slight miscalculation means that only a portion of a brush is in contact with the slip ring intended for it.

Other equipment needed . . . To calculate input horsepower, an accurate measure of shaft speed is vitally important. For this, Mid-Valley uses a stroboscope flashing on line frequency — 3,600 flashes per minute. All pump units in the system operate near 3,600 r.p.m. This allows actual speed to be determined by the slip method, i.e., counting slip of the shaft for a 1-minute period and subtracting from 3,600 r.p.m. As a check, the approximate r.p.m. is measured with a hand tachometer of the friction-drive type.

Other items of equipment include all devices necessary to measure hydraulic quantities to calculate output horsepower of the pump. A portable mercury manometer, with a range of 0 to 200 in. of H_2O, measures drop across the station orifice fitting for later calculation of flow. Regular bourdon-type gages measure pressure differential across the pump. These gages have ranges of 0-400 and 0-1,000 psi. and are deadweight tested and calibrated before use. A Ubblehode viscosimeter, a 0°-100° F. thermometer, and a hydrometer complete the test equipment.



OVER-ALL arrangement of torque metering equipment. Fig. 5.

Pump Test Procedure

At least two men are needed to take data. Also, a mechanic is needed to install the torque coupling.

"These tests are an engineering approach to better maintenance"

Whenever possible, the tests are run when the line is pumping light oil. One type of oil which Mid-Valley commonly handles has a gravity of about 42° A.P.I. and a viscosity of around 65 S.U.s. With this oil in the line, pump units can be carried beyond their normal maximum capacity without greatly overloading drivers.

Also, when possible, tests are scheduled at a time when a station needs only one unit in operation. Additional load beyond normal pumping load is applied to the test unit by opening the station bypass. Power would be wasted needlessly if a second unit were in series with the test unit.

Before starting the tests, stations up and down the line are notified and every attempt is made to keep flow completely stabilized.

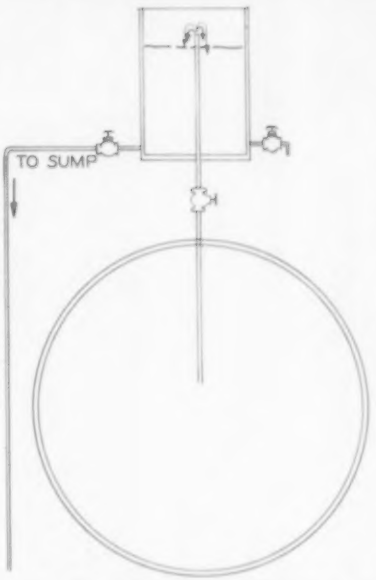
Seven measurements . . . Readings are taken on seven different variables to determine pump efficiency. Measuring torque and shaft allows calculation of input horsepower. Readings needed for hydraulic horsepower are: (1) pressure across the pump, (2) rate of flow, (3) viscosity, (4) temperature, and (5) gravity.

. . . Torque and shaft speed are measured with the equipment described above. The brush holder and stand for the torque device must be bolted down under the coupling. Holes are star-drilled in the concrete floor and lead expansion anchors used for securing the bolts. The torque meter must be zeroed at no load but this is only a meter adjustment. Figs. 4 and 5 show the arrangement of torque equipment.

As loads are varied during the test, the engine governor will hold speed within a few r.p.m.'s of rated speed. The engine is then adjusted manually, using the stroboscope as a reference, to a speed as close to rated pump speed as possible.

. . . Differential pressure across the pump is measured with bourdon-type gages which are deadweighted and calibrated before and after each pump test. Surge chambers used with the gages are needed to dampen vibrations, allow more accurate readings. These are hooked up as shown in Fig. 6.

. . . Viscosity readings are made for each load setting during the run. Usually about three measurements are taken and checked for repeatability to ⅓ second. Curves are provided with the viscosimeter for conversion of readings directly to centistokes during the tests. This viscosity measurement is primarily to allow correction of measured pump head and efficiency from a viscous to a water basis.



SAMPLES are taken from well through which portion of stream flows continuously. Fig. 7.

. . . Gravity and temperature are taken with each load setting. A conventional sample well, shown in Fig. 7, has a portion of the stream bubbling through it at all times. Readings made, on samples from this well, accurately reflect conditions of the stream.

. . . Rate of flow is calculated from measurement of differential pressure across the station orifice plate. All Mid-Valley stations have orifice flow meters and recorders but for test purposes a sensitive manometer must be used.

Before the tests start, line flow is stabilized for at least 2 hours. During this time, the actual average rate of flow is determined by tank-gage readings from the nearest upstream terminal, either Mayersville, Miss., or Longview, Tex., which is delivering the entire stream out of tankage.

Also during the interval, temperature, viscosity, gravity, and orifice plate differential are measured and an average rate of flow calculated from those readings. A general flow formula, $Q = CBF_v (h_m/G_l)^{1/2}$, is used. (See Spink, L. K., "Principles and Practice of Flow Meter Engineering," 7th edition, p. 95) where:

- Q = flow rate in thousands of barrels per day
- C = constant depending on orifice, volume units, etc.
- B = factor to correct for fluid gravity varying from that of water at 60° F.
- F_v = viscosity correction factor
- h_m = differential across orifice, in. H_2O
- G_l = specific gravity of flowing fluid at 60° F.

Values of C are worked out ahead of time for each station on the line. Test engineers merely take gravity, temperature, and differential, plug values in the formula, and grind out a calculated Q. For the initial calculation F_v is assumed to be 1.00.

This calculated Q is then compared with the actual Q as determined from tank-gage readings. The ratio of actual and calculated Q is multiplied by F_v and the new factor used in the formula for calculating flow during the horsepower test run.

Complete curve taken . . . To get a pump-characteristic curve, at least five sets of readings in the operating range are taken. The first or low set of readings must be taken at the particular flow rate at which the line is operating. Other readings are spaced evenly between that set and those for a flow rate of 255,000 bbl. per day.

Loading of the pump to take readings above operating flow rate is done by cracking the station bypass valve. Mid-Valley has found that its line stabilizes rapidly if flow is raised about 10,000 bbl. per day above the desired rate, held for about 30 seconds, then slowly reduced to the desired rate.

At the end of all test runs, the pump's viscous brake horsepower, capacity, head, and efficiency are calculated. These are corrected for viscosity according to curves of the Hydraulic Institute. This correction amounts to about 2 per cent on efficiency when tests are run during pumping of the low-viscosity oil.

Corrected curves are plotted and compared to manufacturer's shop curves. Deviation is analyzed as to whether it could be caused by errors in test procedure or need of maintenance on the pump. If performance curves are more than a point or two low, the complete test is rerun. Then, if efficiency or head is still low, the pump is dismantled for inspection and repair. Usually the field test curves can be duplicated, testifying to accuracy and completeness of the method.

These tests are not primarily to check a manufacturer's performance figures. They constitute an engineering approach to closer maintenance, establishing a base to make recommendations for pump or engine repair.

Reference

1. Seely, Fred B., Resistance of Materials, John Wiley & Sons, Inc., second edition, p. 67.

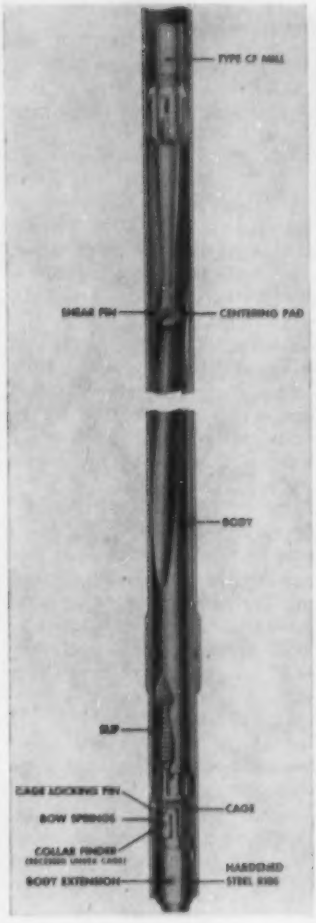


Fig. 1.

Fig. 2.

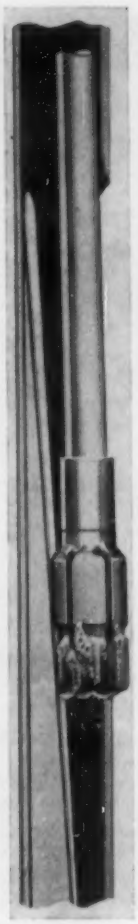


Fig. 3.

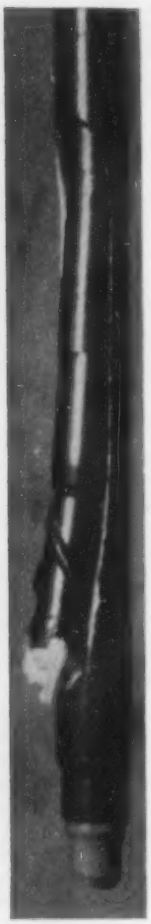


Fig. 4.

CUTTING A WINDOW, the whipstock is set in the hole with the attached CF mill, Fig. 1. When the pin is sheared, the mill moves downward and centering pad forces it into casing wall, Fig. 2. After the window is started, a CA mill finishes the job, Fig. 3. Fig. 4 is retrievable whipstock and flexible pipe used for starting drain holes.

Built-in shock absorbers overcome tungsten carbide's shortcoming of sensitivity to shock, providing a

New Down-Hole Tool For Oil-Well Milling

by Jack Chadderdon and C. O. Van Note, Jr.

CASING, tubing, liners, and junk of any form are being milled out of wells at rates far faster than formerly because of a new method of suspending particles of tungsten carbide in a tough but elastic matrix. Remedial work which took days is being done in hours.

Tungsten carbide inserts and other forms of the material have been used for years to hard-face bits, stabilizers, and other drilling tools. It is fused to rock-bit cutters. Drag-type bits contain embedded slugs or inserts. Stabilizers are dressed with a welding rod containing particles of tungsten carbide. It is contained in hard-facing materials used on cutter and milling knives.

Use of tungsten carbide in the machine-tool industry during the last war caused a major revolution in that industry. In some cases machine time was speeded up by more than 1,000 per cent.

The problem . . . These experiences were not duplicated, however, when fishing-tool companies attempted to use tungsten carbine inserts in the knives of inside and outside cutters for drill pipe and casing. Service companies specializing in milling windows or sections in casing likewise were unsuccessful with inserts on the cutting surfaces of whipstock mills and section mills.

This was due to tungsten carbide's inherent sensitivity to shock. Conventional methods used for attaching the material to tool holders were not successful when rugged down-hole conditions were encountered in oil well milling.

This might be expected. When used in a rigidly mounted tool holder, tungsten carbide will cut with amazing speed. But a long string of drill pipe is not a rigid mount. It is a simple matter to change a tool holder on a machine. To change a mill in an oil well requires that the pipe be pulled.

Because of its sensitivity to shock, therefore, tungsten carbide as a steel-cutting medium until only recently was relegated to aboveground uses.

The solution . . . The rugged conditions encountered in down-hole cutting and milling are overcome in the new cutting material (trade-marked Servcoloy, patent pending). Tungsten carbide particles are provided with built-in shock absorbers by suspending them in a resilient matrix. Vibration is coped with metallurgically in the same manner that springs and shock absorbers on a car mechanically absorb bumps in the road.

Instead of one piece of tungsten carbide, hundreds are used. Each is suspended in a tough but elastic binder material. Each exposed particle performs a portion of the work. When it is worn or torn from its exposed cutting position, a new particle takes over the cutting or milling duty.

Compared with diamonds . . . From this brief account it is readily seen that tungsten carbide particles are readily expendable. Such is not the case with diamonds.

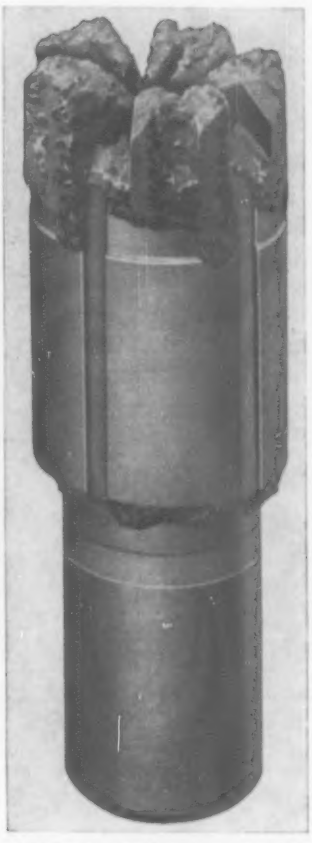
Diamond, the hardest substance known, is placed at 10 on the Moh hardness scale. Tungsten carbide is approximately 9, but a better comparison is offered by the Knoop scale shown in Table 1.

All of these materials are shock sensitive. However, good commercial dia-

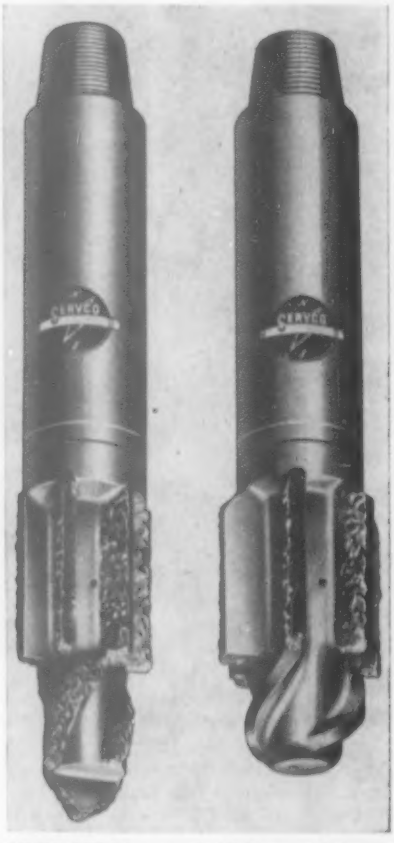
Authors are vice president of engineering and executive vice president, respectively, of Servco Co., Long Beach, Calif.

DRILLING

TUNGSTEN CARBIDE dressed taper mill is used for reaming casing windows and a variety of other jobs. Fig. 5.



JUNK MILL has many cutting edges all heavily dressed with the tungsten carbide cutting material. Fig. 6.



LINER MILLS can mill off the top of damaged casing or liner hangers and liners inside casing and below casing shoe. Fig. 7.

TABLE 1—KNOOP INDENTATION HARDNESS OF MATERIALS HARDER THAN A MOH'S HARDNESS OF 8

Moh scale	Material—	Knoop scale
10	Diamond	6,000-6,500
9	Sapphire	1,600-2,200
	Boron carbide	2,250-2,260
	Silicon carbide	2,130-2,140
	Aluminum oxide	1,625-1,680
	Tungsten carbide	1,050-1,500
8	Topaz	1,250

monds that have no cleavage planes are compact and offer good resistance to breaking forces.

Diamonds perform an important task in the oil industry. In the field of hard-formation coring, their work is outstanding and economical.

The diamonds are set in a hard and abrasive-resistant matrix usually containing powdered tungsten carbide. Loose junk in the bore hole or abusive treatment that will tear them from the matrix can sometimes make their use expensive. There is a wide gap on the hardness scale between diamonds and the carburized surfaces of bits and tool-steel blades on mills. This gap is now being filled by tungsten carbide due to the novelty of making the expendable particles continuously available at the cutting surface.

It is interesting to note that diamonds and tungsten carbide do not compete. They supplement each other. And it is even more surprising to find shock-sensitive tungsten carbide now doing outstanding work in the field of abusive milling which generally encompasses milling sections, permanent whipstock milling, washing over, and specialized fishing operations that require steel cutting.

Whipstocking application . . . In whipstocking applications, tool-steel mills are run at speeds of 20 to 30 r.p.m. and weights of 1,000 to 2,000 lb. This results in milling rates of 1 to 4 in. per hour. Comparable tools dressed with the new cutting material are run at speeds of 70 to 120 r.p.m., weights up to 20,000 lb., and mill at rates of 8 to 36 in. per hour. The spread in milling rates is due to the variation in grades and weights of casing.

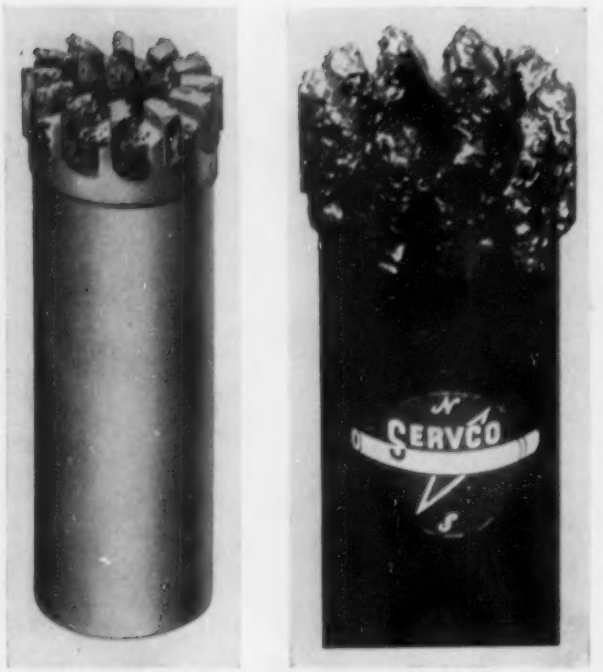
A permanent-type whipstock designed for use with the new mills is shown in Fig. 1. Using the simple J-slot principle, it sets by rotating 90° to the left. This releases the spring-actuated collar finder and retains the cage in set position. Weight down sets the slip as the bow springs support the weight of the cage and slip.

If the job requires a collar set, the whipstock is pulled up until the collar finder engages in the recess of the casing coupling. Shear pins in the locator fail at 2,000 to 3,000 lb., as can be determined from the weight indicator.

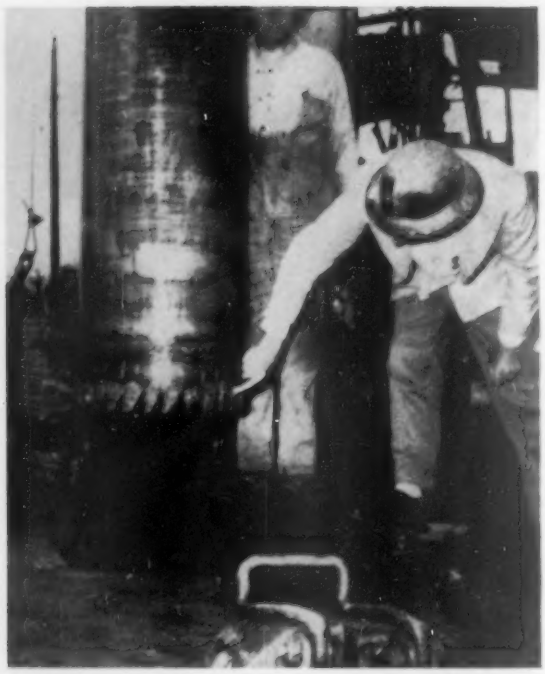
The whipstock is then positioned relative to the coupling and set by applying weight. At approximately 20,000 lb. weight, the pin which attaches the type CF mill to the whipstock is sheared.

Cutting window . . . When rotation is started and the mill moves downward, the tapered extension to the mill engages the centering pad. This forces the cutting edges of the mill into the casing wall. After approximately 2 ft. has been cut, with the centering pad being milled away in the lower portion of the first foot, the CF mill is pulled and a type CA mill run.

Fig. 2 shows the CF mill when it is about 1½ ft. down the whipstock, and



WASHOVER SHOES dressed with tungsten carbide material can do general cutting, left, or outside cutting only, right. Fig. 8.



COLLAPSED CASING, 24 in. in diameter, was milled out by this 21½-in. washover shoe. Fig. 9.

Fig. 3 shows the CA mill after some 4 ft. of window has been cut. The CA mill, like the CF type, is an inserted-type blade mill dressed with the new tungsten carbide material.

Ruggedness of these mills can be illustrated by the way they stand up under rough usage. Sometimes the CA mill will slow down when the center of the whipstock is reached. This is due to the mill being on dead center, with the resulting tendency to core the mill rather than cut casing. Spudding of the mill a few times, to bend or abrade the dead center area, followed by use of higher weights and rotating speeds has been the solution to this.

Milling time required for some of the many whipstock jobs performed in the past year are shown in Table 2. Average total time for cutting a 12-ft. window is approximately 8 hours. Most of the jobs were done with either 6⅛ or 7⅝-in. mills.

. . . Drain-hole drilling from a retrievable whipstock is carried out with a type CP mill. (Fig. 4). Using flexible drill pipe, Oil Well Drain Hole Drilling Co. reports average milling time through most J-55 casing as 1½ hours. Time for N-80 casing is approximately 2½ hours.

Fig. 5 shows a taper mill which is used for a variety of specialized work. This type also is sometimes used on whipstocks for reaming a window. Over 75 per cent of whipstock work, however, is done with the types shown in Figs. 2 and 3.

Junk mills . . . Rugged mills similar to the CA type are used for milling junk. As shown in Fig. 6, it is heavily webbed with tungsten carbide to assure smooth running and to provide a greater number of cutting edges.

This style has been used in a number of abandoned wells which were cleaned out for use as gas-injection wells. All manner of junk, such as chain, sucker rods, and pump pistons, was milled. In addition distorted casing and all types of internal restrictions were cut.

It was used to completely mill a 9⅞-in. bit and four loose cones. The job, completed in 20 hours, was carried out at a depth of 8,500 ft. in hard chert and sandstone. Prior to milling, the hole had been cemented.

In the Atwood area, California, a 5-in. liner had collapsed around 2½-in. tubing. In the fishing operation an inside cutter had broken off and could not be recovered. Using a 4½-in. o.d. type CJ mill, 16 ft. of tubing (including one coupling) and the broken cutter were milled out in 20 hours.

Liner mills . . . The type used for milling off the top of damaged casing, so that subsequent washing over can be carried out, is shown in Fig. 7. It mills liner hangers and liners both inside the casing and below the casing shoe. The pilot ahead of the mill can be dressed with tungsten carbide material to cut out collapsed portions of the liner, as well as sand, scale, and other anomalies.

Examples of work done with this mill include: (1) In the Dominguez area 17 ft. of 7-in., 29-lb. J-55 liner cut in 4 hours; (2) in Santa Fe Springs field, 39 ft. of 5½-in., 18-lb. liner milled in 28½ hours, and (3) at Signal Hill, 29 ft. of 4¾-in. o.d. prepacked liner wrapped with wire mesh required 7¼ hours' milling time.

In the Sunset Beach area this type mill required 5 hours to cut 3 ft. of lead-seal liner hanger which had been pulled into the collapsed section of 7-in. casing. About 12 ft. of 5½-in. liner was freed and subsequently recovered. A new CL mill then milled 44 ft. of 20-lb. N-80 liner in 22 hours. The mill was pulled "green" for examination and the one used to cut the liner hanger again run. It cut an additional 38 ft. in 20 hours. A total of 82 ft. of blank and perforated liner was cut in 42 hours.

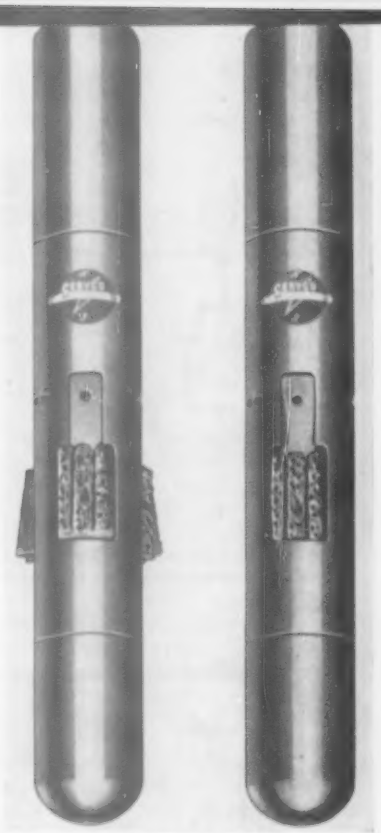
Washover shoes . . . Many varied and difficult jobs have been carried out with washover shoes dressed with the tungsten carbide material. Some are dressed to cut on inside diameter only or outside diameter only, have special trimmer pads, or have special tooth design (see Fig. 8).

Fig. 9 shows a 21½-in. shoe used to mill inside some 33 ft. of collapsed 24-in. casing. Fresh water was circulated and a junk sub was run on 5⅞-in. drill pipe above the wash pipe to catch the larger steel cuttings.

Two used rotary shoes are shown in

MILLING OUT CASING wore down shoe at right and shoe at left cleaned up the hole prior to patching. Even when carbide material is worn down, cutting surfaces are still available. Fig. 10.

CUTTING ABILITY of imbedded tungsten carbide particles allowed the slicing off of this reamer and carburized cutters. Hole was at a high angle which made cutting off-center. Fig. 11.



CASING SECTION mills have hydraulically operated cutter arms shown expanded at left and depressed at right. Fig. 12.

Fig. 10. The shoe at right milled out 30 ft. of collapsed 7-in., 32-lb. N-80 casing. The one at left, equipped with outside centralizing pads, was used to clean out prior to patching the casing. Time to mill out the collapsed area of 30 ft. was 14 hours.

Fig. 11 offers an excellent example of tungsten carbide's tremendous cutting ability. The reamer shown was recovered after being washed over. The work was done in a high-angle hole. Cutting was off-center so that about one-fifth of the body of the reamer was milled off. As shown, a cut was made through the carburized reamer cutter and alloy cutter pin.

Innumerable jobs have been performed to release packers. In one well an elapsed time of about 3 hours was required to mill enough of one packer so that the slip could release. The remaining mandrel and tubing below the packer was then recovered with an overshot.

In the Long Beach Harbor area a shoe cut over the packing elements and retaining rings of an open-hole drill-stem tester. Some 2 hours was required to complete milling of the packer, and 3 hours additional was needed to wash over approximately 300 ft. of 4½-in. tail pipe.

Casing section mills . . . Newest milling tool is a hydraulic section mill shown in Fig. 12. The cutter arms, shown expanded in the left view, are actuated by pump pressure. Time required for cutting through the casing varies from 30 minutes to 4 hours, depending upon pump pressure available and the weight and grade of the casing.

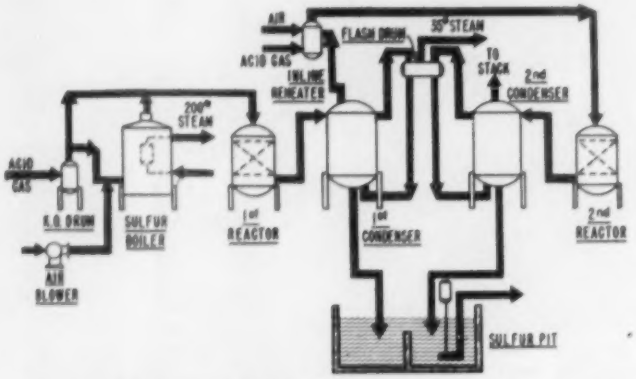
As detailed in Table 3, the first three jobs with the section mill were carried out on 7-in. N-80 and P-110 casing. Each job included milling one coupling; on two jobs the couplings were extreme-line box and pin. Two sets of cutters were required for each job but it is believed that most jobs can be done with one set of cutter arms.

TABLE 2—DATA ON TYPICAL WHIPSTOCK JOBS

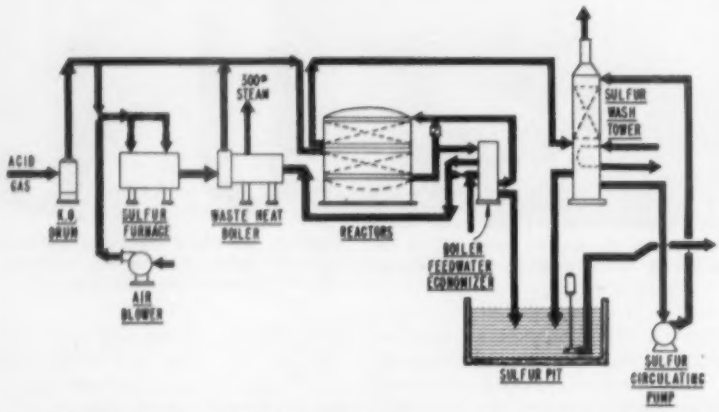
Casing Size (in.)	Casing Weight (lb.)	Grade	Area—	No. mills used	Total footage milled, ft.	Total milling time, hours
8⅝	23	C	Huntington Beach	2	12	3¼
5½	15	J-55	Southward, Calif.	2	12½	5¾
7	24	H-40	Lomita, Calif.	2	11½	7¼
7	20	N-80	Huntington Beach	2	12	7
8⅝	28	J-55	Huntington Beach	2	12	5½
5½	15	J-55	West Texas	2	12½	5¾
8⅝	32	C	Wilmington	2	12	3¼
10¾	45	D	Wilmington	2	12½	5½
8⅝	32	D	Long Beach Harbor	2	11½	5½
11¾	60	C	Huntington Beach	2	12	7½
8⅝	38	C	Torrance	2	11½	6½
8⅝	26	J-55	Huntington Beach	2	11½	13
7	38	N-80	Ventura	4	12	16
9⅝	51	C	Wilmington	2	12	10
5½	15	J-55	West Texas	2	12½	7
7	24	C	Wilmington	2	11½	6
7	38	N-80	Ventura	4	12½	16
9⅝	45	D	Long Beach	2	12	5½

TABLE 3—PERFORMANCE OF CASING SECTION MILLS

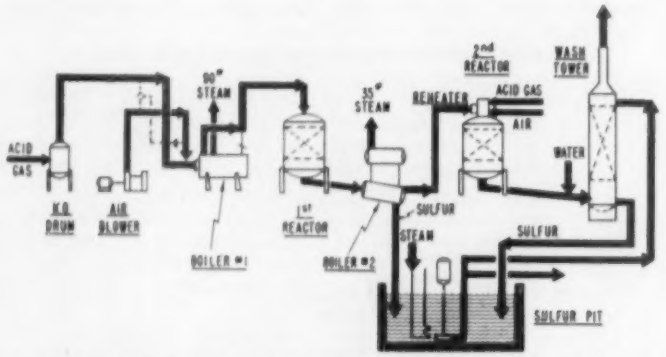
Size, in.:	Weight (lb.) and grade	Depth	Total footage milled, ft.	Total milling time, hours	Couplings milled	No. cutter arms used
7	28, N-80	7,329	42	30½	1	2
7	29, P-110	11,225	20	24½	1	2
7	32, N-80	11,220	25	32	1	2



A **CORROSION WAS MINIMIZED in Plant A by replacing the water-tube boiler with one of fire-tube design. Fig. 1.**



B **EXTERNAL INSULATION of metal surfaces in Plant B has helped to reduce corrosion materially. Fig. 2.**



C **WATER-INJECTION troubles in Plant C led to the installation of a shell-and-tube water cooler. Fig. 3.**

Stanolind Fights Corrosion in Three Sulfur Recovery Plants

by J. W. Kilmer, M. H. Rahmes, and H. L. Lawler

CORROSION has been encountered in three sulfur-recovery plants operated by Stanolind Oil & Gas Co., and corrective measures have been taken to economically prevent the corrosion. The principal cause of the corrosion is solution of corrosive gases in moisture condensed from the process stream.

In the modified Claus process combustion air is added directly to the entire feed-gas stream, after which the mixture is passed through a combination combustion chamber-waste heat boiler in which 50-65 per cent of the hydrogen sulfide is converted into sulfur.

The effluent gas may be cooled for removal of sulfur before it is passed over a catalyst for further conversion of the remaining sulfide and sulfur dioxide.

Conditions . . . Sulfur - recovery plants operate at 5 psig. or less. Flame temperatures in the boiler or combustion chamber are in the order of 1,800° to 2,300°F. Reactor inlet temperatures range from 400° to 500°F. and reactor outlet temperatures may be as high as about 800°F. Reactor effluent streams are usually cooled to about 300°F. for condensation of sulfur vapor.

Besides hydrogen sulfide, sulfur dioxide, sulfur vapor, and water the various process streams usually contain considerable nitrogen and carbon dioxide, and may contain small quantities of carbonyl sulfide, carbon disulfide, oxygen, and hydrocarbons.

Plant A

In Plant A (Fig. 1) one-third of the inlet stream was originally burned in a vertical water-tube boiler. The effluent products of combustion were mixed with the remaining two-thirds of the plant inlet stream and passed to a reactor containing catalyst. From the reactor the stream passed through a condenser where it was cooled with resultant condensation of sulfur and attendant generation of 35-psi. steam.

The remaining gas was then reheated by means of an in-line burner and then passed to a second reactor and second condenser-separator. Waste gases were then disposed of in a stack.

The product sulfur flowed by gravity to an underground pit containing steam coils and was pumped from this pit to solid storage.

Shortly after startup, serious corrosion was encountered in the combustion boiler. Products of combustion penetrated openings in the refractory lining of the furnace and condensed on the cool steel shell. Similar condensation and attendant corrosion occurred in

Authors are with Stanolind Oil & Gas Co., Tulsa. Paper presented at 1956 annual N.G.A.A. meeting, Fort Worth.

After redesign . . . "no major indication of . . . attack by H_2S has been found in the three plants other than the possibility in case of the radiant cone in Plant A."

the plenum chamber beneath the burners. After 1 year's operation it was necessary to replace the entire outer shell of the boiler and redesign the plenum chamber.

Further corrosion of the stainless-steel radiant cone at the combustion zone of the boiler, failure of the lead rupture disk at the top of the furnace, pilot and main burner failure due to corrosion, all led to eventual replacement of the vertical water-tube boiler with a horizontal Scotch marine-type boiler.

It is believed that failure of the radiant cone may have been due to sulfiding. Failure of the lead rupture disk has been attributed indirectly to bimetallic cell action. Actual corrosion damage occurred to the stainless-steel retaining flanges which in turn caused mechanical failure of the lead disk. Corrosion of the pilot and main burners may have been due, at least in part, to condensed water particularly during shutdowns. Additional corrosion encountered at this plant included failure of the overhead line from the boiler downstream of the point where the combustion products join the acid gas bypass line.

The plant has stainless-steel catalyst supports and screens, stainless-steel piping from the reactor outlets to condenser separators, and refractory lining in the reactors. Otherwise, bare carbon steel is used throughout.

Plant B

At Plant B (Fig. 2) one-third of the inlet stream together with sufficient air is burned in a reactor furnace from which the combustion gases pass to a waste heat boiler where they are cooled and 300-psi. steam is produced. The cooled combustion gases are mixed with the remainder of the plant inlet stream and passed to a reactor where a portion of the sulfur is formed.

From this reactor a portion of the gases passes through a boiler-feed-water economizer where sulfur condenses and the gas is cooled. The remainder of the effluent gas from the first reactor is bypassed to control inlet temperature to the second reactor. From the second reactor, the gases flow to a sulfur wash tower where the sulfur is removed and the waste products passed to a stack for disposal to the atmosphere.

Heat removal in the wash tower is accomplished by liquid sulfur reflux which is cooled by a water coil in the base of the wash tower. All sulfur collected drains by gravity into a sulfur pit. From this pit sulfur may be transferred to either liquid-sulfur loading facilities or to solid storage.

Cover plates . . . Minor corrosion has occurred on the steel sulfur-pit cover plates. This has been attributed to solution of corrosive gases in moisture condensed on the cold surfaces. Additional corrosion has been encountered in the economizer, apparently due to failure of the refractory lining and resultant condensation of moisture on the carbon steel shell.

The loading line for sulfur tank cars is steam jacketed to a point near the cars. At the point where the steam jacket ends several failures of the internal line have been encountered. Carbon steel and Type 304 stainless steel have both failed, and Carpenter 20 has recently been installed in an effort to solve the problem. Failure was attributed to the presence of wet sulfur dioxide gas formed by entry of air into the loading line when the sulfur in that line drains back to the pit between loading operations.

The combustion chamber, the effluent line to the waste heat boiler, the first-stage reactor, and the economizer are lined with refractory. In addition, the catalyst supports are made of cast iron and the catalyst screen and one butterfly valve are stainless steel. With these exceptions the entire plant is constructed of carbon steel.

Plant C

Plant C is a straight-through plant, (Fig. 3) that is, acid gas flows through an inlet scrubber at the sulfur-recovery plant and then the entire stream passes into the boiler, together with sufficient air to burn one-third of the hydrogen sulfide. The products of combustion are passed to the first reactor and then through a second waste-heat boiler where additional steam is generated and the major portion of the sulfur is condensed.

The effluent-gas stream is then reheated and passed through a second reactor where additional sulfur is formed. Final cooling is accomplished by water injection into the gas stream. The water-injection nozzle is located on the center line of the gas-inlet nozzle and the water sprays in the direction of gas flow.

Liquid sulfur reflux is supplied from the storage pit solely as a wash to scrub droplets of liquid sulfur from the gas stream. Product sulfur from the pit is pumped to either liquid shipping facilities or solid storage.

Water-injection troubles . . . Corrosion was found in the wash tower when a hole in the shell appeared at a point directly opposite the inlet nozzle. This seems to indicate that complete vaporization of the water injected is not obtained continuously and that the remaining free water is responsible for the corrosion. A shell-and-tube water cooler is being installed to permit cooling by means of the reflux stream.

When this installation is complete, water injection will cease. External corrosion of the steam coils in the vapor space above the sulfur in the storage pit has also occurred. Plans to keep a slow flow of steam through these coils will reduce and possibly stop the attack.

The main flow lines in this plant are cement lined and the reactors are lined with refractory. The catalyst retaining screens are stainless steel. With these exceptions the plant is entirely constructed of carbon steel.

Examination of the conditions leading to most of the corrosion reported reveals that condensation of moisture took place. Considerable water is formed in the reactions occurring in sulfur plants and water dew points of most process streams are in the order of 140°F. Solution of the problem may take two courses. The first is redesign of equipment so that contact of the process stream with cold metal surfaces is minimized.

Substitution of a fire-tube boiler for a water-tube boiler at Plant A is an example of such redesign. The second method of corrosion mitigation involves external insulation of the metal surfaces so that they do not cool to the water dew point of the process stream. Observation of these two basic ideas in the design of a sulfur-recovery unit should result in an operating unit relatively free of corrosion without the use of expensive alloy construction.

To date no major indication of high-temperature attack of steel by hydrogen sulfide has been found in the three plants other than the possibility in the case of the radiant cone in Plant A. However, the areas which should be most susceptible to such attack, e.g., the outlet side of the reactors, are protected by refractory lining.

In Southwestern Ontario . . .

Gravity Survey Pays Its Way

Drilling in area confirms 25 per cent of the anomalies

by W. B. Dyer

THE first well to obtain commercial production from the Salina-Guelph zone in southwestern Ontario was drilled in Essex County in 1889, on the theory that the productive Cincinnati anticline of Ohio extended into this part of Ontario. All drilling done from that time, until fairly recently, was essentially shooting in the dark, for surface outcrops of rock are very scarce, and there was little reliable subsurface information.

In 1930, Union Gas Co. located, quite by accident, an unusual and highly productive field in Dawn Township, Lambton County. The discovery well obtained an initial open flow of over 7 M.M.c.f. per day, from the Guelph formation, at a depth of about 1,600 ft. On further drilling, the structure was found to be quite different from anything known in the area up to that time, for it showed a relief of about 300 ft. above the surrounding Guelph, and covered an area of only 132 acres.

The author is with Union Gas Co. of Canada, Ltd., Chatham, Ont. This is an abridged version of a paper that originally appeared in Canadian Oil and Gas Industries under the title, "Gravity Prospecting in Southwestern Ontario."

A few years later, just 2½ miles to the northeast, a second field, of almost the same proportions, was discovered. The pore volume in both is exceptional, for the content of the two small fields together was originally about 15 billion cubic feet.

Several theories were put forth to account for the origin of the unusual structures, and it was eventually concluded (Evans, 1944) that they must be organic reefs, or bioherms, of the type found previously in Indiana and Illinois.

It seemed logical that if two such fields could occur so close together in the area, there might easily be others. Thus, the very real problem of locating more such tiny fields presented itself, and many methods have since been tried, with varying success.

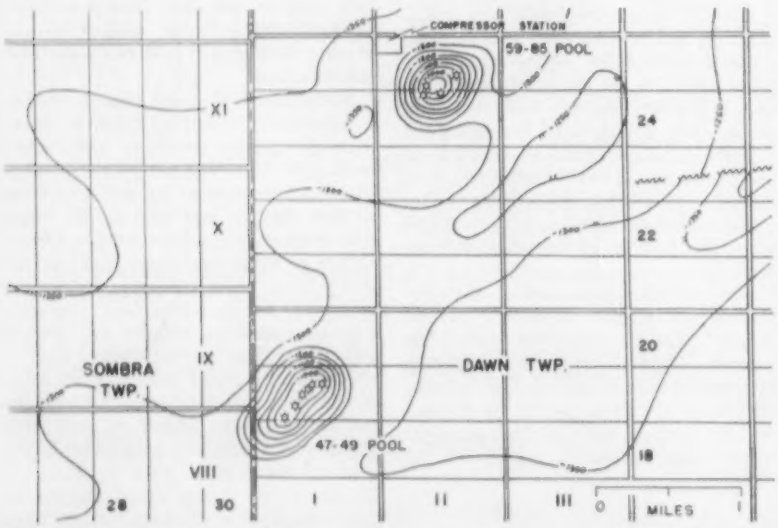
Early exploration . . . One of the first efforts made was an intensive program of shallow-test drilling, in hopes that the strata a few hundred feet below the surface would reflect deeper structures. While it was known that a gentle arching of these rocks did occur over one of the reefs (Fig. 2) the widespread salt beds of the Salina formation just above the Guelph were missing here. There was no such reflection above the other where salt did occur (Fig. 3), and when it was eventually realized that the blanketing effect of salt would probably disguise any underlying features in most of the area, this testing program was abandoned.

Several attempts were then made to apply the science of geophysics to the problem. Most of the known methods were tested at one time or another to determine what sort of information they would yield. Some of the methods did outline large structural features, most of which were of deep-seated origin, but others failed altogether. The irregularity in thickness and composition of surface material, the lack of good physical property contrast between strata in most of the section, and in some cases the coarseness of grain of the surveys, contributed to the failure of this work in locating the smaller structures.

Since gravity appeared to be the only approach that showed any promise at all, it was decided to conduct a closely controlled experimental survey over our two reefs in Dawn Township. Two profiles were run over each, with stations spaced 200 ft. apart, and when the work was completed in 1950, the results were gratifying indeed. A fairly well defined anomaly was found over each of the reefs, of about the same size and shape as the structures were known to be.

It had been predicted, from a study of cuttings and logs of nearby wells, that because of the high porosity in the upper part of the reefs, causing a deficiency in mass, any anomalies that might be found would be negative, or below the regional gravity. Both the anomalies, however, were found to be low-intensity positive types, about 3 or 4 tenths milligals above regional.

Two diamond-drill cores were taken near the area, and a reexamination of the geological variables was made, on the basis of rock-density tests of the



PORTION OF DAWN TOWNSHIP, showing structure contours on top of Guelph formation, and productive reef wells. Contour interval 50 ft. Fig. 1.

EXPLORATION

core. It became evident that both positive and negative mass effects could play a part in the final gravity picture, and that the positive effects might easily be the stronger by such a small amount as a fraction of a milligal.

Since the specific gravity of salt is about 2.2, or 0.6 less than most of the shales and dolomites above and below it, a local thinning or absence of salt above a reef could cause a definite positive effect. Since a shale or dolomite would be locally thicker to compensate for the thinned salt, the result would be a mass effect in excess of regional, coincident with the irregularity in the strata. This has been proved since to be a very common occurrence above reefs, and is probably the most significant factor of all in detecting them.

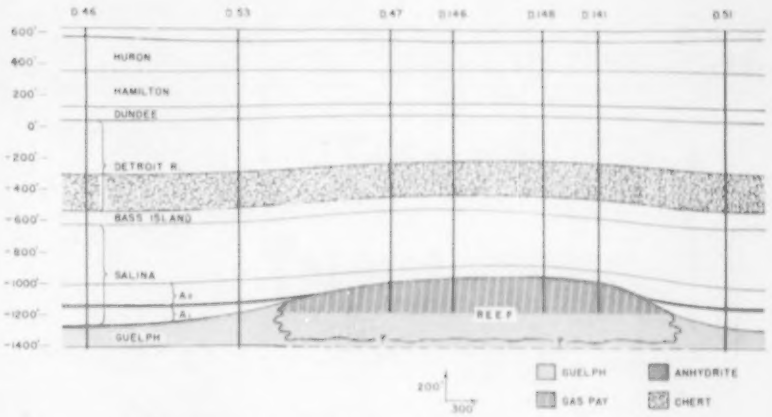
Another factor which could contribute to a positive effect would be a local arching of the sediments deposited over a structure of this type. Although there are only a few stratigraphic contacts, other than at salt beds, across which there is a measurable density difference, the majority are found high in the section. While any upward structural reflection would be expected to be minor more than a few hundred feet above a reef, it can be calculated (Dobrin, 1952, p. 19) that such a feature could at least contribute towards the positive effect.

It is believed likely that the lower part of the reef core, and the underlying sediments, would be more compact than normal sediments at corresponding depth, possibly due to differential compaction. If this is so, it would have the effect of creating excess mass associated with a reef, and thus contribute further towards a positive effect.

Conversely, negative gravity effects could be caused by local thickening of the salt, depression of the strata, or variations in the surface material. The net result, the gravity anomaly, is thus seen to be caused by an accumulation of mass effects, and can be positive, negative, or undetectable, depending on local conditions.

As noted previously, just one of the Dawn reefs is overlain by salt. Since the salt was deposited around the flank of the reef and sediments covering it before becoming a continuous bed, there is a decrease of about 180 ft. in salt thickness directly attributable to the presence of the reef. It can be shown from calculations of the mass effect of this deficiency, that nearly the whole of the anomaly can be explained by this thinning.

The arching of the sediments over the neighboring reef, which lies in a narrow elongated belt of no salt, together with the dense material of the reef core, is believed in this case able to cause at least most of the anomaly.



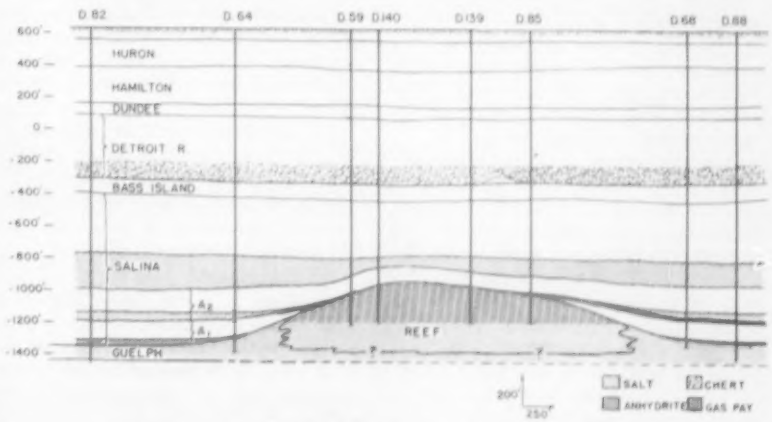
STRUCTURE SECTION through Dawn 47-49 reef. Fig. 2.

There are many geological features which can occur in reef areas whose effects can distort, or even destroy, anomalies which might otherwise have been indicative. Rapid changes in salt thickness, whether due to original conditions of deposition or to later removal by leaching or flowing under pressure, is without doubt the most important of these.

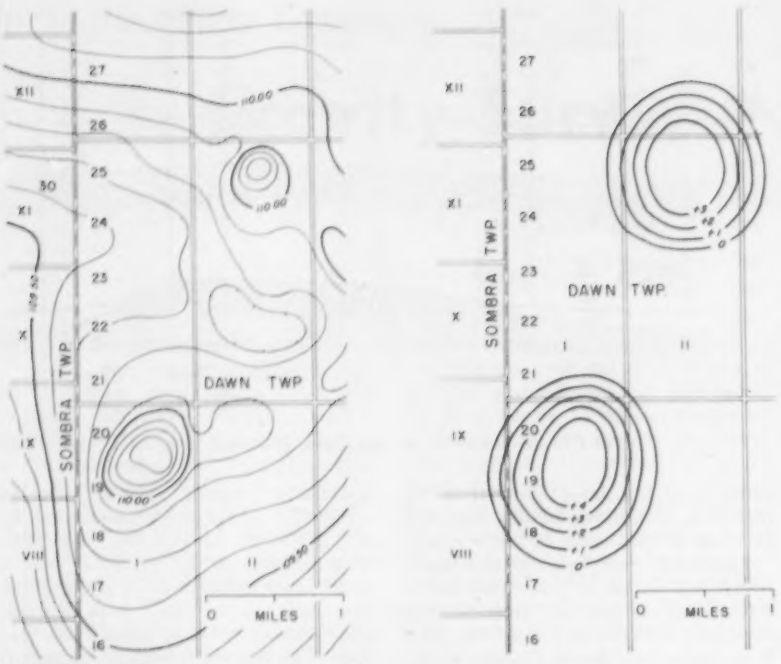
Some other interfering factors can be faulting, the presence of dense gravel or boulders in the drift, and irregular mass distribution in the pre-Cambrian. Fortunately, however, a reef anomaly can sometimes be detected, upon very careful examination of the total gravity map, as a minor local flexure in the contours of a larger anomaly caused by one or more of these disturbances.

Gravity survey . . . On the strength of the knowledge gained in the preliminary work, Union Gas Co. decided to conduct a complete survey, designed to suit the geological conditions and aimed specifically toward locating Silurian reefs. The program recommended by Richard Pohly, at that time with Seismograph Service Corp., Tulsa, was a preliminary reconnaissance along all of the roads in the area, with stations spaced about 1,000 ft. apart. This was then to be supplemented with additional detail to be given by interior stations when anomalies were indicated by the main control lines.

Pohly (1954) in his paper presenting a case history of one of our successful anomalies, gives a fairly complete description of the methods employed in the survey to assure accuracy in the gravity measurements, and in the determination of elevation and location of each of the stations occupied by the meter. It had been realized that extreme accuracy would be required throughout the entire survey, for it was expected that reef anomalies would be not only small but frequently of very low intensity, and thus difficult to isolate from the regional gravity. Furthermore, it was known that the structures themselves can be of such size that one could be totally enclosed within adjacent roads, and might thus af-



STRUCTURE SECTION through Dawn 59-85 reef. Fig. 3.



BOUGUER GRAVITY (left) and smooth-curve residual gravity (right) over Dawn 47-49 and 59-85 reefs. Fig. 4.

fect the values of only one or two stations at best.

Since 1951, over 1,000 sq. miles have been surveyed for Union Gas Co., in the areas closest to our markets, and believed to be prospective. A large part of this was done with a portable gravity meter, for the purposes of interior control. Hundreds of anomalies were detected on the total gravity maps, and the job then became one of selecting the most promising for testing by the drill.

Interpretation

The services of a skilled geophysicist, familiar with the regional geology, and experienced in other localities with similar geological and geophysical characteristics, are of great advantage in the work of interpreting the gravity. In selecting anomalies suitable for drilling, he should consult frequently with a geologist who has done considerable work in the area, and has access to all available well records and other detailed geological information.

A mathematical analysis of the anomalies before drilling is of little importance in this area. It has been proved many times that we can expect no consistent relationship between the intensity of an anomaly and the size of a reef, so that any interpretation of the gravity must be qualitative. As far as reefs are concerned, the empirical approach is best, for if only those anomalies which satisfied any prior quantitative analysis had been drilled, some of the best reefs in the area would have remained undiscovered. The magnitude of reef anomalies can vary from eight-tenths milligal to zero, and perhaps even below regional.

The criteria used in selecting anomalies then, since intensity is of little value, are their shape and areal extent. The known reefs in southwestern Ontario are generally quite uniform in size, shape, and depth, so that anomalies were chosen for testing that appeared to be of corresponding dimensions. James Shouldice (1955) in his paper summarizing the dimensional characteristics and geological environment of southwestern Ontario reefs, states that the average area of the larger pinnacle-type structures is about 460 acres, the average length about 6,000 ft., and the average width about 3,800 ft. The average dimensions of the base of the gas pay in the productive reefs, however, are believed by the writer to be about 3,300 ft. long by 2,000 ft. wide.

An additional guide in selection is the fact that the majority of residual anomalies which overly reefs in the area have been found to be gravity maxima surrounded, in most cases, by low intensity negative values.

Limitations . . . A very important fundamental limitation of the gravity method must be kept constantly in mind when it is applied to the search for reefs. This is its inherent ambiguity, a characteristic which makes it impossible to determine in advance what set of geological conditions have caused a particular anomaly. Many authors, (Skeels, 1947) have demonstrated that widely different structural features, of varying depth, size, and density, can cause an identical gravity anomaly. The ambiguity has nothing to do with the spacing or precision of the observations, for it has been proved that regardless of the treatment of the data, no computational procedure can extract a unique solution from gravity measurements.

In our own area, for example, an anomaly which might be selected for its shape, area, and environment in the total gravity field as one indicative of reefing, might just as easily be caused by such other features as local variations in drift thickness and density, sharp changes in salt thickness, an outlier of denser shallow Port Lambton beds, or flexure in the higher strata.

It is indeed certain that all reef-type anomalies which prove unsuccessful, must be caused by some other combination of geological features which would account for them, although these may not be readily apparent.

Role of geologist . . . Any comments on the local geology in the present paper are necessarily generalized, and confined to illustration of some of its effects on the gravity. The references list several reports covering this field in detail.

As noted earlier, the most effective disturbing factor to the over-all gravity picture is the highly variable nature of the salt beds of the Salina formation, which are found throughout most of the area, and lie just above the Guelph reefs. The reefs can vary from several hundred feet in thickness to complete absence, within a distance of less than ½ mile.

In any case, anomalies caused by the thinning or absence of salt, whatever the cause, must be credited almost entirely with locating many of the structures.

Testing the anomaly . . . When it has been decided by the geologist that an anomaly meets the favorable conditions of environment and size, a fairly standardized program of testing is carried out. The first well is generally located in the center of the most intense part of the anomaly, and unless a productive reef is encountered, it is carried through to the base of the Guelph formation.

Cable tools are used for practically all drilling in southwestern Ontario, for reasons of economics. Completion depths are usually not great, for the tops of the reefs themselves are seldom more than 1,500 to 2,000 ft. below the surface.

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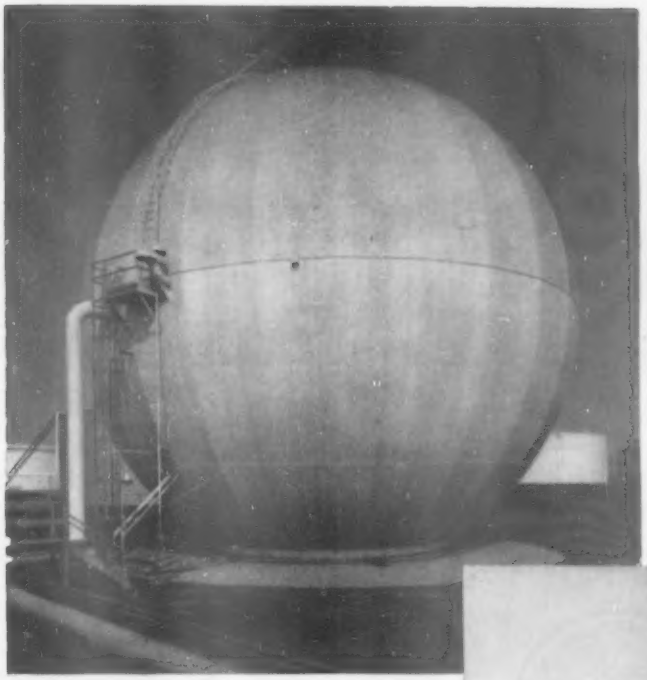

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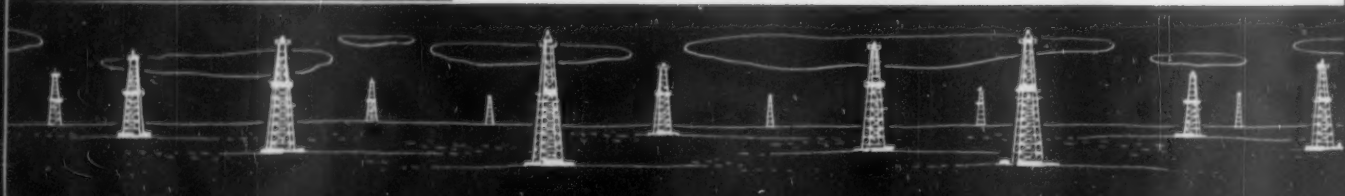

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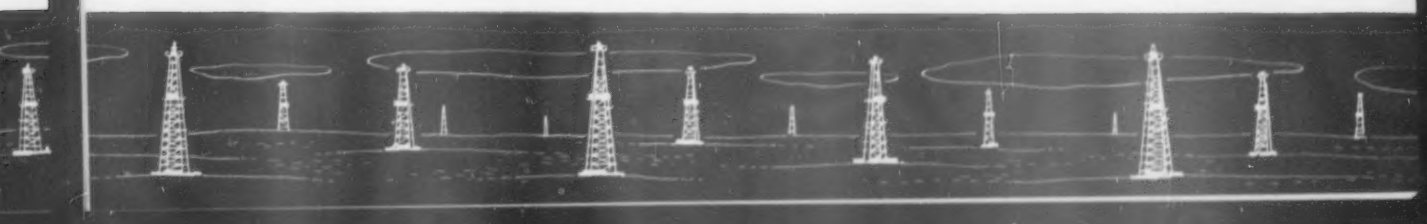

well data, to determine if there is any structural variation from expected regional in the locality. Even minor thickening of the Guelph, or thinning of the overlying Salina sediments and its salt beds can be a clue to the nearby reefs. Shows of gas and oil in the lower Salina have also been noted to occur frequently in the area around reefs, and serve as another guide to possible reefing.

It is difficult to say how many wells must be drilled on an anomaly before it can be condemned as barren. This would depend on the prospect rating of the locality, the regional geology, the size and shape of the anomaly, the number and quality of clues provided by earlier wells, and of course the economics of risk. In one anomalous area, another company found it worth while to drill seven wells in order to prove the presence of a reef; six more were drilled before reef production was obtained.

On the other hand, anomalies can frequently be condemned on the basis of only one well. This would be the case, for example, where salt is found to be absent, or much thinner than normal, this can be due to a sort of dish-shaped indentation in the top of the salt (probably caused by localized leaching), and where the underlying strata consequently have a more or less regional attitude. It would be almost certain that the anomaly here can be totally explained by this feature. Additional wells would have little chance of finding other significant structure.

Drilling Results

In the 62 years between 1889 and 1951, by which time most of the gravity work had been completed, 15 reefs of the small bioherm type had been located in southwestern Ontario. Six of these were dry, and the natural open flow of the best well in each of the productive nine averaged 12.7 M.M.c.f. per day. Seven of the fifteen reefs are the short, incipient type, so that the average relief above the surrounding Guelph is just 228 ft.

In the 5 years since 1951, 24 reefs have been discovered. Although most of these were found by gravity, the exact number is unknown since details of the gravity are known by the writer only over Union Gas Co. reefs. Of the 24 reefs, 12 are dry or filled with water, and 2 are potential oil producers. The average natural open flow of the best well in each of the 10 reefs containing gas was 22.5 M.M.c.f. per day. Only 3 of the 24 are the incipient type, so that the over-all average relief above the Guelph is 330 ft.

On completion of the gravity survey, it was noticed that many anomalies enclosed areas in which wells had previously been drilled. A few of these were actually reef wells, but since the majority had been drilled near the edge of the anomaly and had not penetrated, or even reached, the Guelph, little helpful information was obtained as to the value of the anomaly.

TABLE 1—RESULTS OF EXPLORATORY DRILLING

Wells that obtained reef production	6
Wells that obtained production from other than reef	5
Dry holes	82
Per cent of completely tested anomalies that found reefs	26
Per cent of these anomalies that have proved:	
(a) Productive of gas	55
(b) Productive of oil	11
(c) Dry, or water-filled	33
Number of wells required on successful anomalies to locate the reef:	
Average	2.00
Maximum	6.00
Minimum	1.00
Number of wells required on unsuccessful anomalies in order to condemn them:	
Average	1.54
Maximum	4.00
Minimum	1.00

The summary of drilling which follows is based exclusively on Union Gas Co. wells, and those in which the company had a participating interest (Table 1).

In order to give as clear a picture as possible of the value of gravity to date, only exploratory wells, drilled since the survey and on reef-type anomalies, are included in the tabulation. Drilling is here considered exploratory so long as actual reef production is sought, regardless of the degree of structural evidence or any Salina production obtained from previous wells.

Conclusion . . . Table 1 clearly shows that gravity has proved itself to be a very effective tool in helping to locate reefs in our area. Although the ratio of dry holes to productive reef wells may seem high, when one considers the size of the structures, and what the ratio might have been without the help of gravity, there is no doubt that the survey has paid its way.

In 5 years of intensive exploratory work on anomalies, many reefs have been discovered, many dry holes have been drilled, and much has been learned in the process about what we can, and should not, expect of gravity. One of the lessons learned, in fact, is that a dry reef—a definite and frustrating failure from a geologist's point of view—must be classed as highly successful geophysics.

It must always be kept in mind that gravity is fundamentally incapable of distinguishing between effects associated with reefs, and those caused by other structural conditions. For this reason, every well drilled must be carefully examined and analyzed for any geological evidence which may indicate proximity to a reef, or otherwise explain the anomaly.

Geology and geophysics must always work together. Any knowledge of local geological features acts as an independent control in interpretation, and can greatly reduce the otherwise inevitable ambiguity. As each well is drilled on an anomaly, it should be possible to decrease the number of variables and narrow the range of uncertainty.

It is difficult to make any prediction about the result of a drilling well, for it has been found that gravity anomalies, and the combination of geological conditions which give rise to them, can be almost infinitely varied. Furthermore, it is frequently difficult to reconcile one in the light of the other, even after all the available facts are known. It is doubtful if any two anomalies, reefs, or even wells, are alike, so that there seems always to be something new, or unexpected about every well drilled to test gravity.

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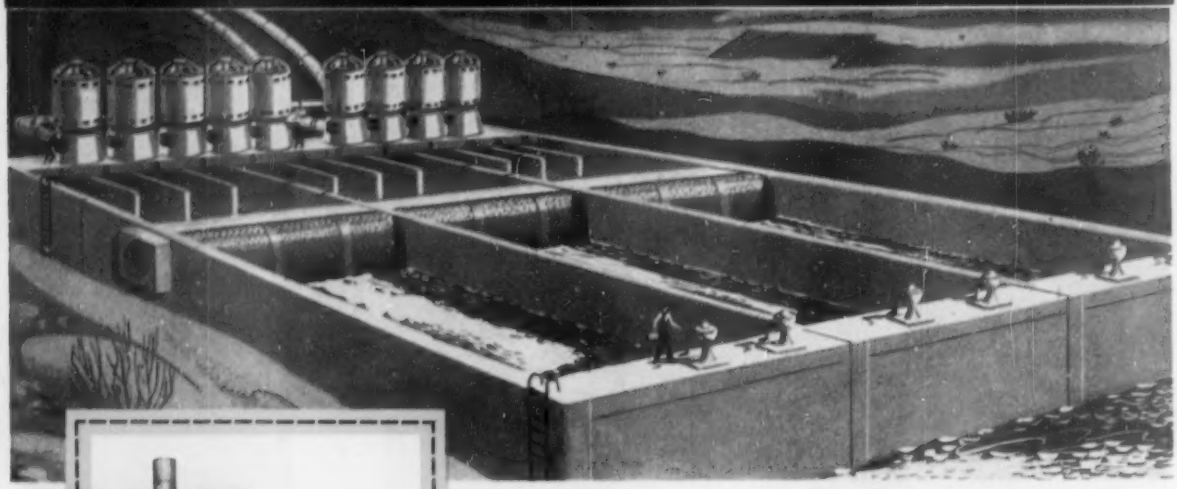

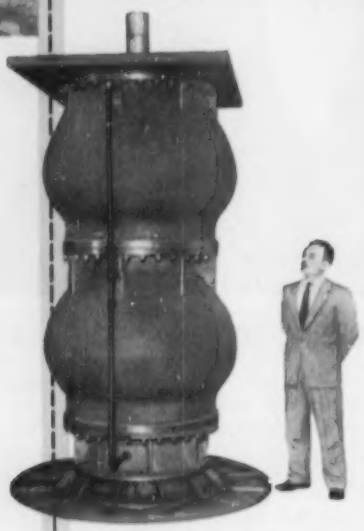

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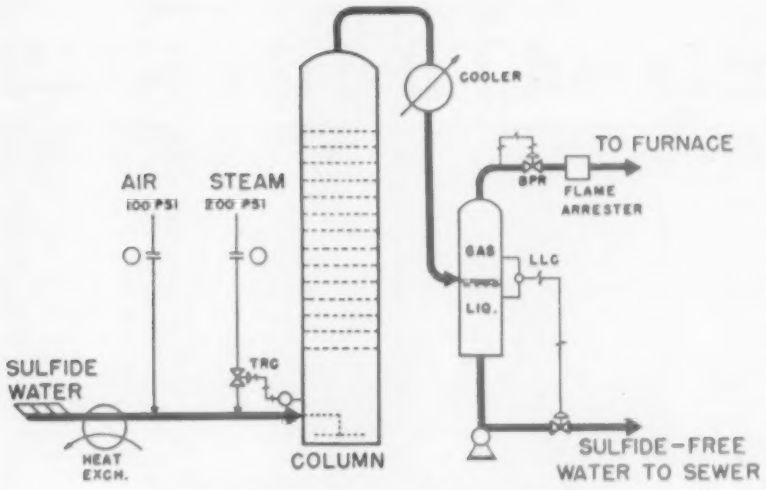


FLOW DIAGRAM of air-oxidation process. Fig. 1.

Air-oxidation process is cheap, practical means of

Ridding Process Waters and Caustic Solutions of Sulfides

Advantage: disposal of sulfide-bearing waters without pollution of either the atmosphere or surface waters

by A. G. Smith

AN air-oxidation process has been developed which makes possible the disposal of sulfide-bearing waters without objectionable pollution of either the atmosphere or surface waters. The process involves conversion of sulfides to thiosulfates at elevated temperatures and pressures.

Three units are now in operation and oxidize both process waters and caustic solutions which contain up to 50,000 p.p.m. of sulfides. In each unit the sulfide concentration can be reduced to less than 1 p.p.m. The largest of the three units was converted from steam stripping to air oxidation at relatively low cost.

This oxidation process was developed and applied at Shell's Wilmington-Dominguez refinery in the Los Angeles Basin, where both water and air-pollution abatement are continuing problems. Effluent water from this refinery flows through a drainage channel into the Los Angeles Harbor, and the sulfide concentration in the effluent is limited to a maximum of 1 p.p.m.

The process as based on the conversion of the obnoxious sulfides to the less objectionable thiosulfates with air at elevated temperatures and pressures. The thiosulfates are water soluble and are retained in the refinery-effluent water. Although thiosulfates are unobjectionable in most refinery effluents, they do have an appreciable oxygen demand and may be troublesome in some areas.

Author is with Shell Oil Co., Wilmington, Calif. Paper presented at A.P.I. Division of Refining midyear meeting, Montreal, 1956, under the original title, "Air Oxidation of Sulfides in Process Waters and Caustic Solutions."

Oxidation Reactions

The principal reactions involved in the oxidation process are as follows:

$$2S^{=}+2O_2+H_2O \rightarrow S_2O_3^{=}+2OH^{-} \quad (1)$$

$$2HS^{-}+2O_2 \rightarrow S_2O_3^{=}+H_2O \quad (2)$$

The theoretical oxygen requirement in the above reactions is approximately 1 lb. for each pound of sulfide; on this basis, oxidation of 1 ton of sulfur each day will require approximately 80 standard cubic feet of air per minute. However, in the operation of plant units it has been necessary to use somewhat more than the theoretical amount of air. In addition, it has been found that a small portion of the thiosulfate is further oxidized to the sulfate form with a resultant increase in oxygen usage. It is interesting to note that the oxidation of 1 mole of sodium sulfide (Equation 1) will regenerate 1 mole of sodium hydroxide.

The reaction is exothermic and results in an appreciable temperature increase of the solution when the sulfide concentration is high. For example, when oxidizing a spent soda containing approximately 5 per cent by weight of sulfide, the temperature of the solution increased more than 100° F. as a result of the oxidation reaction.

Process flow . . . A simplified flow diagram of the oxidation process is shown in Fig. 1 and is based on a unit oxidizing approximately 3,000 bbl. per day of sour water from thermal and catalytic cracking processes. The sulfide water is preheated to about 160° F. by exchange with hot residue; this preheating is an economy measure and is not required before the introduction of air.

Compressed air is then injected into the water and followed by sufficient steam to reach the desired reaction temperature. The air and steam inlets are simple T-pipe connections; introduction of air before the steam prevents the usual hammering from rapid condensation of steam. Air flow is hand-controlled by a globe valve, and temperature is regulated by a recorder controller on the steam flow.

Water and air enter the bottom of the column through a special distributor and both phases flow upward out of the column through a cooler into the gas-liquid separator. Sulfide-free water is then drained from the separator to the sewer through a valve regulated by a liquid-level controller.

The exhaust gas is discharged through a back-pressure regulator into the firebox of a nearby furnace. Although the gas is normally free of hydrogen sulfide, it does contain a small amount of ammonia and hydrocarbons. In addition, it is possible that the gas could contain traces of hydrogen sulfide during short periods of abnormal operation.

A flame arrestor is provided in the waste-gas line to the furnace. Although the exhaust gas is not explosive, it is possible that explosive conditions might occur during abnormal operating conditions. As an additional safety pre-

caution, steam is injected into the waste-gas line to the furnace.

Applications of Process

Three oxidation units are now in operation at our Wilmington-Dominguez refinery and process solutions which have a wide range of sulfide concentrations. The largest of these units is charged with approximately 3,000 bbl. per day of process water from thermal and catalytic cracking units. This process water is essentially an ammonium sulfide solution and contains approximately 7,000 p.p.m. of sulfide.

A second unit oxidizes a spent sodium-hydroxide solution that contains a very high sulfide concentration of 50,000 p.p.m.

The third unit is charged with a mixture of sour condensate and soda from a crude-oil-distillation unit which contains only 700 p.p.m. of sulfides. The type of solution, i.e., ammonium or sodium sulfide, is an important factor in the operation of the units. The source and sulfide concentrations of water charged to the three units are shown in Table 1.

Approximately 4 tons of sulfides are oxidized by the three units each day. If this quantity were stripped from the solutions and burned in a furnace, approximately 8 tons of sulfur dioxide would be emitted into the atmosphere.

Temperature, pressure, and air rate are the important operating variables for this process and their effect on design and operation of the various units is discussed in the following sections. Typical operating data for the three units are shown in Table 2.

Temperature . . . Temperature is perhaps the most important variable in the design and operation of the units. Oxidation rates of sulfides in solution increase with temperature and this effect is illustrated in Fig. 2. The data are based on the batchwise oxidation of a sodium sulfide solution in a laboratory column, 6 in. in diameter, 3½ ft. long, packed with ½-in.-diameter raschig rings.

TABLE 1—SULFIDE WATER CHARGED TO OXIDATION UNITS

	Unit number		
	I	II	III
Source of water	Thermal and catalytic cracking units	Crude-oil-distillation unit	Soda treating of cracked C_3 and C_4
Sulfide concentration, p.p.m.	7,000	700	50,000
Feed rate, bbl. per stream day	3,000	600	*300
Sulfide oxidized, tons per stream day	3.5	0.07	*2.7
Cation type	NH_4+	NH_4+ and N_a+	N_a+

*Unit in operation only 4.5 days per month.

TABLE 2—TYPICAL OPERATING DATA

	Unit number		
	I	II	III
Temperature, °F.	200	150	250
Pressure (top), psig.	60	10	35
Feed rate, bbl. per stream day	3,000	600	300
Air rate, std. cu. ft. per minute	600	20	350
Air rate, per cent of theoretical requirement	210	130	150
Sulfide in feed, p.p.m.	7,000	700	50,000

Pressure was constant at 50 psig. with a superficial air velocity of 0.0018 ft. per second. The laboratory oxidation rates shown in Fig. 2 are appreciably lower than rates in continuous plant units.

The shapes of the oxidation-rate curves indicate that the kinetic order for the reaction changes from zero to first order at lower concentrations. Similar curves were obtained with ammonium sulfide solutions except that the oxidation rate appeared to be much faster than for sodium sulfide solutions.

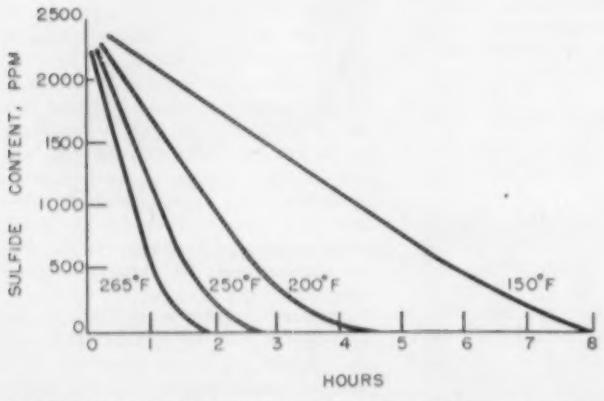
The data in Fig. 2 indicate a continuing increase in oxidation rates with temperature, but, in the oxidation of ammonium sulfide, excessive temperature may cause an apparent decrease in the reaction rate. Partial pressure of hydrogen sulfide and ammonia increase with temperature, and as a result, stripping of hydrogen sulfide from the solution will occur at higher temperatures. Since the apparent oxidation rate of the sulfide in the gaseous phase is very low, if not negligible, a rapid decrease in the over-all oxidation rate will result.

This reduction in oxidation capacity as a result of stripping was observed during the first days of operation of Unit I. When the column temperature was increased to 260° F., the sulfide content of the water drained to the sewer was 2,000 p.p.m., while the concentration in a water sample from the top of the column was much lower, 500 p.p.m. Thus it appeared that a portion of the hydrogen sulfide was stripped from the liquid phase within the column and was reabsorbed as it passed through the cooler into the gas-liquid separator.

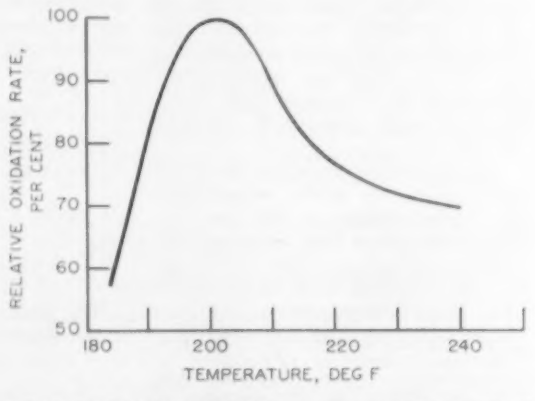
Another factor related to temperature is that the partial pressure of oxygen in the constant-pressure system will decrease at higher temperatures. As a result, the driving force for transfer of oxygen into the liquid phase is decreased.

As a result of these factors, the oxidation capacity of a unit processing ammonium sulfide solutions will reach a maximum value and then decline rapidly as the temperature is increased. This effect is illustrated in Fig. 3 which shows the oxidation capacity of Unit I as a function of temperature.

The optimum temperature for maximum capacity on Unit I is approxi-



EFFECT OF TEMPERATURE on batchwise oxidation of sodium sulfide solutions. Fig. 2.



EFFECT OF TEMPERATURE on apparent oxidation rate of aluminum sulfide in Unit No. 1. Fig. 3.

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mately 200° F. Temperatures several degrees above or below 200° F. will result in an unsatisfactory product containing appreciable quantities of sulfide. The sulfide in the product below 200° F. is the result of the slower reaction rate, and a sulfide-free product could be obtained by reducing the feed rate.

However, at temperatures well above 200° F., the lower oxidation capacity is the result of stripping the hydrogen sulfide from the liquid, and therefore, a sulfide-free product cannot always be obtained by reducing the feed rate.

It should be pointed out that this temperature-capacity curve of Fig. 3 is valid only for Unit I and at the conditions outlined. The optimum temperature for an ammonium sulfide solution can be shifted slightly in this or other units by changes in air rate, pressure, and degree of mixing. For example, a sulfide-free product was obtained at 230° to 240° F. when 1,000 bbl. per day of Unit I feed was charged to Unit III which normally oxidizes sodium sulfide solutions.

The stripping of sulfide is not an important factor in oxidation of the sodium sulfide solutions, and therefore, the sodium solutions are oxidized at higher temperatures. As shown in Table 2, oxidation of a spent soda on Unit III is accomplished at 250° F., while the ammonium sulfide-type water is oxidized at 200° F. in Unit I. The 150° F. temperature of Unit II is significantly lower than the other units because the sulfide load is only a fraction of the potential capacity.

Pressure . . . Sulfide-oxidation rates can be increased by pressure. Increased pressure at constant temperature will increase the partial pressure of oxygen and the driving force for transfer of oxygen into the liquid phase. In addition, a higher pressure will reduce the stripping effect in ammonium sulfide solutions and thereby permit operations at higher temperatures.

Units I and III are operated at the maximum safe working pressure of the vessels in order to achieve maximum oxidation capacity.

Air rate . . . The basic function of the air is to provide oxygen for the chemical reaction, but excess air can also be used to improve the oxidation rate. The effects of increasing the air rate are: (1) to improve gas-liquid contact by increased agitation and (2) to accelerate the transfer of oxygen from gas to liquid by raising the average partial pressure of oxygen in the gas phase.

Units II and III are normally operated with only 130 to 150 per cent of the theoretical quantity of air required to oxidize the sulfides in the water. In the case of Unit I the air usage has been considerably higher and averaged approximately 200 per cent of the theoretical requirement. A large portion of this excess air is charged to the column to compensate for variations in the sulfide concentration of the feed.

The sulfide load on this column has changed as much as 100 per cent within a few hours. It has been possible to reduce the air consumption to 140 per cent to 150 per cent of the theoretical during periods of uniform feed composition and feed rate. Further reduction might be accomplished in a column of more suitable design.

Oxidation-column design . . . Functions of the oxidation column are: (1) to provide good contact of the gas and liquid phases and (2) to provide sufficient time for the reaction to be completed. Experience at the Wilmington-Dominguez refinery indicates that several types of refinery columns will provide these two basic requirements.

Each of the three oxidation units now in operation represent a different type of internal design: one is equipped with grid trays; another, bubble-cap trays; and the third, a packed column. The details of these columns are shown in Table 3.

TABLE 3—OXIDATION-COLUMN DIMENSIONS

	Unit number		
	I	II	III
Height, ft.	35	57.5	575.
Diameter, ft.	6	3	3.5
Trays	14	(*)	30
Type	Grid	Packed*	Bubble cap
Spacing, in.	18	(*)	18

*Packed with 30 ft. of raschig rings.

The type of column was not selected for each unit on the basis of any known advantage for each type; the variation was primarily the result of utilizing existing spare equipment. The Unit I column had been in service as a steam-stripping column for the same sour water now being oxidized. Unit II column was a small fractionating column that was idle.

On the basis of experience with these columns, it appears that a tall narrow column is more desirable than a relatively short and wide vessel. In the case of the short column, backmixing or internal recirculation of the water throughout the length of the column would cause a portion of the feed water to reach the outlet before oxidation is complete, and result in a product containing a high concentration of sulfides.

In an effort to minimize this backmixing in the short column of Unit I, the free area of every third grid tray was reduced from 22 per cent to 5 per cent.

Uniform distribution of the air and water charged to the column is an important factor in the satisfactory operation of the unit. Performance of Unit I was markedly improved by the installation of a feed distributor with eight radial spokes which produced a uniform distribution across the lower cross-sectional area of the column.

The use of mechanical-mixing equipment in place of columns was investigated briefly in laboratory equipment, and the oxidation rate of a sodium sulfide solution in a turbomixer was seven times greater than in a packed column. Even though mechanical mixing would permit smaller units and possibly lower air consumption, these savings could not justify the high installation and operating costs of mechanical mixers when spare columns are available.

Catalysts . . . Oxidation rates of sodium sulfide and ammonium sulfide can be increased by the addition of catalysts. Tannic acid, sodium picrate, sodium picramate, and phenolic compounds extracted from gasoline are examples of several oxidation catalysts that were found to be effective.

Sodium picrate and sodium picramate were the most effective but their use is relatively expensive; addition of these chemicals to obtain a 10 per cent increase in the oxidation rate of the sulfide water charged to Unit I would cost approximately $20 per day. This sum could be spent more effectively on providing additional equipment to improve the capacity of the unit.

An example of additional equipment to improve the performance of an oxidation unit is a pretreater that was installed on Unit I. An existing heat-exchanger shell downstream from the feed heat exchangers was converted to a pretreating unit.

Air and heated sour water are introduced through a horizontal 4-in. by 10-ft. pipe distributor; air passing through the distributor perforations provides thorough agitation and the heat-exchanger shell provides a residence time (based on liquid, hourly space velocity) of approximately 5 minutes.

It appears that approximately 20 per cent of the total oxidation now occurs in the pretreater and the total air consumption of the unit has been reduced as much as 30 per cent at high-sulfide loads.

Operation and control . . . Operation of the columns is relatively simple and requires only part-time attention by an operator. The operator adjusts only the air rate to maintain a sulfide-free product with minimum air consumption.

Temperature and pressure are automatically controlled and are not changed during normal operation.

Sulfides in the product are determined by a lead-acetate test and electrometric titration with silver nitrate. The oxidized water is tested with lead-acetate solution each hour by the operator. Although this method is qualitative and does not detect sulfides below a few parts per million, the method is satisfactory for plant control.

Once a day a sample of product is checked by the electrometric-titration procedure in the laboratory for quantitative determination of the sulfide concentration.

It should be noted in connection with the discussion of analytical methods that the Methylene-Blue Colorimetric Method—A.P.I. Method 711-53, cannot be used to determine sulfide levels in oxidized water. Thiosulfate interferes with the procedure, resulting in low or completely negative results.

The operators of Unit I were quick to observe a color change in the oxidized water that has been useful for control of the column. They noted that the color of the water changed from a pale greenish-blue to light amber when the oxidation was complete. If the oxidation were not complete and the product contained even a low concentration of sulfides, the treated water would not be amber.

Oil contamination was one of the most troublesome factors during the early operation of the unit processing the sulfide water from the thermal and catalytic-cracking area. Small amounts of oil caused a sharp decrease in the oxidation capacity and a high sulfide level in the treated water.

This effect was demonstrated when sulfide water was pumped from a storage tank through a pipeline which contained small amounts of oil from previous service. Within an hour, the sulfide content increased from zero to 1,500 p.p.m. and remained at a high level for several hours after the flow of contaminated water was discontinued.

Subsequent pilot-plant studies indicated that 5 per cent of this oil, a 200-F to 700+-F cracked fraction, would reduce the oxidation rate approximately 50 per cent. The effect of oil contamination will probably vary with the type of oil, column design, temperature, and other operating conditions. Installation of oil separators in the feed line to the unit has resulted in improved performance of the unit.

Corrosion . . . Some corrosion had been expected in the oxidation system, but no evidence of corrosion has been found in the various units, even though mild steel was used throughout two of the units. This absence of corrosion is an additional advantage of the air-oxidation process over the steam-stripping process, where corrosion of equipment had resulted in relatively high maintenance costs.

Cost of operations . . . Cost of utilities is the major cost of operation for the air-oxidation process. Utility charges for the 3,000-bbl. per day Unit I are approximately $30 per day, based on the rates shown in Table 2. Compressed air is the largest portion of this cost and is approximately $20 per day. Operating-labor costs have been negligible because the units are operated by personnel available in the area.

As mentioned before, the large, 3,000-bbl. per day Unit I was converted from steam stripping to air operation, and the cost of conversion was relatively low, approximately $15,000. The major costs for the conversion were piping changes and instrumentation. Conversion costs of other units would be substantially increased if it were necessary to provide a compressed-air supply, other than the refinery system.

Reference

1. Manual on Disposal of Refinery Wastes, Vol. IV: "Sampling and Analysis of Waste Water," A.P.I., New York (1953).

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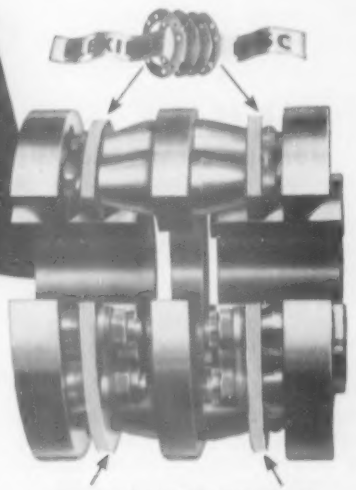

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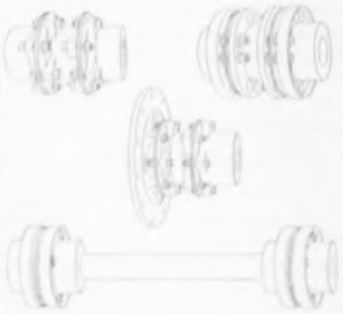

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When corrosion troubles suddenly beset this Texas field, a new method of squeezing liquid inhibitor into the producing formation was used, with the result . . .

Table–1 Comparison of the Various

	Batch treatment						
	Tubing failures per year	Iron content of produced water (p.p.m.)	Net iron production (lb./day)	M.p.y.	Per cent effective	Treating cost, mills— Bbl. oil	Bbl. fluid
No. 1-S	1.2	50.0	2.49	1.99	43	115.9	7.58
No. 2-S	1.2	104.0	5.58	.....	0	70.3	6.68
No. 3-S	.....	.....	.....	.....	.....	.....	.....
No. 4-S	.....	.....	.....	.....	.....	.....	.....
No. 5-S	.....	70.9	3.2	2.08	68	72.3	1.61
No. 6-S	.....	.....	.....	2.94	.....	.....	.....
No. 7-S	0.67	26.0	4.1	4.48	75	85.2	1.27
No. 8-S	1.0	29.0	5.1	2.02	54	30.9	2.17
No. 9-S	.....	22.2	1.1	3.41	88	66.2	1.93
No. 10-S	.....	37.5	2.8	.....	40	167.2	4.56
No. 11-S	.....	34.2	0.5	.....	85	75.4	16.0

*Calculated over 2-month period after squeezing. †Calculated over 5-month period

Inhibition Improved 17 Per Cent, While

by Rupert H. Poetker and John D. Stone

CORROSION control of gas-lift wells is a difficult problem. Usually the corrosion that occurs in these wells is of the water-dependent type; i.e., the wells produce for a number of years without corrosion but when the water production increases sufficiently, corrosion becomes severe. Corrosion control of gas-lift wells is difficult for the following reasons: (1) limitation of treating methods; (2) inability to control chemical-injection location; and (3) inability to economically measure corrosiveness of fluid or to measure the amount of corrosion occurring in the well.

This article discusses these problems and shows what steps have been taken by Sunray Mid-Continent Oil Co. to overcome them. To limit the scope of the article, the corrosion-control program of Placedo field, Victoria County, Texas, will be discussed.

Placedo Field Corrosion

This field was developed in 1936 and 1937 and was produced with no corrosion damage to well equipment for 12 years. Most of the wells in this field are completed in the Greta sand or in a stringer sand slightly above the Greta at a depth of approximately 4,700 ft. The Greta sand is a very loose unconsolidated sand with a permeability of 3,000 to 5,000 md. and a porosity of 32 to 34 per cent.

Tubing failures resulting from corrosion were first noticed in 1948; and by 1951 the corrosion had become a severe problem. Several expensive fishing jobs were required and tubing and valve failures became quite numerous. In 1951 there were around 20 tubing failures caused by corrosion in a field where we operate only 80 wells. The average cost of pulling these wells and replacing the corroded tubing averaged a little over $4,000 per job, giving a total corrosion cost for 1951 of $80,000. Needless to say, corrosion costs in this field were excessive.

Corrosion rate . . . In late 1951 a program was started to determine how much corrosion was occurring and which wells were being corroded most severely. Corrosion test coupons were installed in the high-water-producing wells, caliper surveys were run, and iron content of the produced water was determined.

The caliper surveys showed that the tubing in each of the wells with a high-water-producing rate was in very poor condition. The results from the surface coupons were very inconclusive; in fact, most of the coupons gave a corrosion rate of 2 to 4 mils per year regardless of the well's productivity. The iron content of the produced water was very erratic but did correspond somewhat to the history of the well's corrosiveness.

Treatment was started in some of the wells based on caliper-survey data and well histories, but not on coupon corrosion rates or iron content of produced water. It was hoped that treatment, along with coupon and iron-content studies, would give results which could be used to help interpret previous results.

Batch Chemical Treatment

Chemical treatment was started in a few of these wells in early 1951. However, an organized program was not started until late 1951. The most corrosive wells were those which produced large quantities of water, from 800 to 1,500 bbl. per day.

Treatment with stick chemicals was not feasible inasmuch as it would require a shut-in period of 3 to 4 hours. A shut-in period of this duration would interrupt the well's production and would take 1 to 2 days before the well resumed normal production again. The use of a macaroni string inside the tubing was discarded because it would greatly decrease the efficiency of the gas-lift operation unless larger tubing could be used, and the larger tubing was not available.

The treating method used was that of daily batch feeding chemical mixed with 5 or 10 gal. of well's fluid into the annulus.

Authors are with Sunray Mid-Continent Oil Co., Corpus Christi, Tex., and Baton Rouge, La., respectively. Paper presented at spring meeting of Southern District, A.P.I. Division of Production, San Antonio, under the original title, "Corrosion Control of Gas-Lift Wells."

PRODUCING

Chemical Treatments on Corrosive Wells

Squeeze treatment						Without treatment			
Tubing failures per year	Iron content of produced water (p.p.m.)	Net iron production (lb./day)	Per cent effective	Treating cost, mills Bbl. oil	Bbl. fluid	Tubing failures per year	Iron content of produced water (p.p.m.)	Net iron production (lb./day)	M.p.y.
	28.0	0.69	82	50.3	2.39	2.0	38.0	3.76	8.55
1.5	38.9	4.08	0	63.5	2.55		103.0	2.7	
	24.0	0.72	84	95.7	2.51	2.0	50.4	4.5	4.21
1.7	44.3	4.3	51	44.2	3.18	4.0	96.6	8.8	
	21.1	0.58	94	81.5	1.56	0.96	100.6	10.1	4.00
	*20.7	*0.83	*85	*95.8	*2.19	0.67	30.0	5.5	3.23
	†23.4	†2.3	†58	†33.5	†0.69				
2.4	33.0	7.8	51	43.6	0.99	1.0	46.7	16.0	8.26
	22.1	1.6	86	19.6	1.10	1.7	47.8	11.2	1.96
	20.3	0.51	94	65.8	1.56	2.0	41.1	8.8	2.94
	23.9	1.0	79	168.0	2.83	1.25	57.1	4.7	
	21.3	0.47	86			1.5	101.8	3.3	

after squeezing.

Cost Dropped 50 Per Cent

Results of treatment . . . Because these wells made large amounts of water and considerable amounts of sand at relatively high velocities, the erosion of the coupons by the sand was so much greater than the corrosion rate that little difference in coupon corrosion rate was noticed before and after treatment. The iron content of the produced water, although still very erratic, indicated that some protection was being achieved. These iron counts indicated that a treating efficiency of some 30 to 50 per cent was being accomplished.

Because the iron counts indicated that treatment was somewhat effective and since no other method presented itself, this batch treatment program was continued and expanded to other wells. In April 1954, a severe tubing failure was encountered in a well that had been treated since April 1951. The history of this well follows:

Well No. 1-B. Prior to chemical treatment this well produced between 800 and 1,000 bbl. of brine per day and had experienced three tubing failures due to corrosion. These failures occurred in April 1948, February 1949, and April 1951. After the first failure, a new string of tubing was put in the well and this new string failed in 10 months.

In April 1951, just after a tubing failure, treatment was started in the well. The well was first treated with an inorganic inhibitor for about 6 months and the chemical was then changed to an organic inhibitor. The well was treated with 1 gal. of chemical and 5 to 10 gal. of well's fluid daily for 3 years. This well produced normally and gave no indication of a tubing failure.

However, the well sanded up and a workover was required. The tubing was pulled and was found to be parted at approximately 1,800 ft., just below the upper gas-lift valve. The tubing was then fished and 10 or 15 of the joints that were recovered did not have an upset on either end. The tubing had not been normalized and severe ringworm corrosion had occurred. Corrosion had been so general throughout these joints that a joint could be lifted easily with one hand. However, the tubing above the upper gas-lift valve was in fair condition. It was apparent that chemical treatment had not gone below the upper gas-lift valve.

During this time, iron content of the produced water averaged 31.4, 39.8, and 34.4 p.p.m. for 1951, 1952, and 1953, respectively. The average net pounds of iron produced per day for 1951, 1952, and 1953 is 12.4, 16.6, and 14.6 lb. Several other wells gave similar results; however, the failures were not as severe as this well.

Inhibitor gums up . . . Also, in early 1954 another disadvantage to the batch treatment was discovered. A tubing failure occurred in one well at about the 3,000-ft. depth; and when the tubing was pulled, a coating of chemical from ¼ to ½-in. thick was found on the outside of the tubing. It is believed that this was the result of the use of insufficient diluent with the chemical.

This plating out was probably brought about by the dehydration of the chemical by the gas. The chemical was diluted with only 5 or 10 gal. of water and batched into the annulus. This was just enough fluid to wet the outside of the tubing and inside of the casing; and as the dry gas was injected over a 24-hour period, the chemical was dehydrated and remained on the tubing as a gummy coating.

To verify this theory, the chemical was batched into the annulus and then followed with 2 bbl. of well's fluid. This was done on only a few wells and resulted in reducing the iron content of the produced water a slight amount. The increased amount of wash water improved the treatment but not enough to justify the added expense.

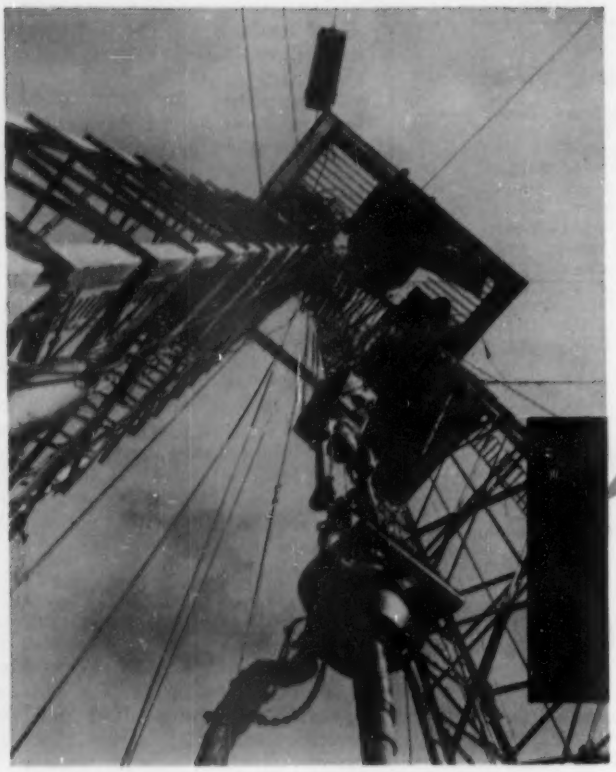
Inhibitor Squeeze

Because the batch-treatment method was not as successful as was desired, a search for a new and better method of treatment was made. The idea of squeezing the inhibitor back into the formation seemed to be worth investigating.

Preliminary laboratory tests were run on sand samples obtained from the Greta formation to determine, (1) whether or not the inhibitor would be adsorbed onto the sand particles; and (2) if the chemical was adsorbed on the sand, at what rate it would be desorbed from the sand by the flow of brine. These tests were run at atmospheric conditions and no definite conclusions could be reached as to what would happen to the chemical in the formation.

However, the results did indicate that it would be possible to "squeeze" the inhibitor into the formation with no adverse effects and that inhibitors with the proper characteristics would adsorb to the sand and would desorb slowly enough to give a period of protection when the well was producing.

Procedure . . . A small triplex pump, rated at 5 g.p.m. and a small centrifugal pump, rated at 40 g.p.m., are used to pump the chemical into the wells. The annuli of the first two wells squeezed were loaded with brine prior to squeezing. However, this has been discontinued and no adverse effects have been noticed. The chemical, usually 55 gal., is pumped into the tubing and followed with 2 qt. of deemulsifying chemical in 15 bbl. of brine or oil. This is then followed by sufficient brine or oil to displace the liquid in the tubing and force the chemical back into the formation the desired distance. The proper distance to force the chemi-



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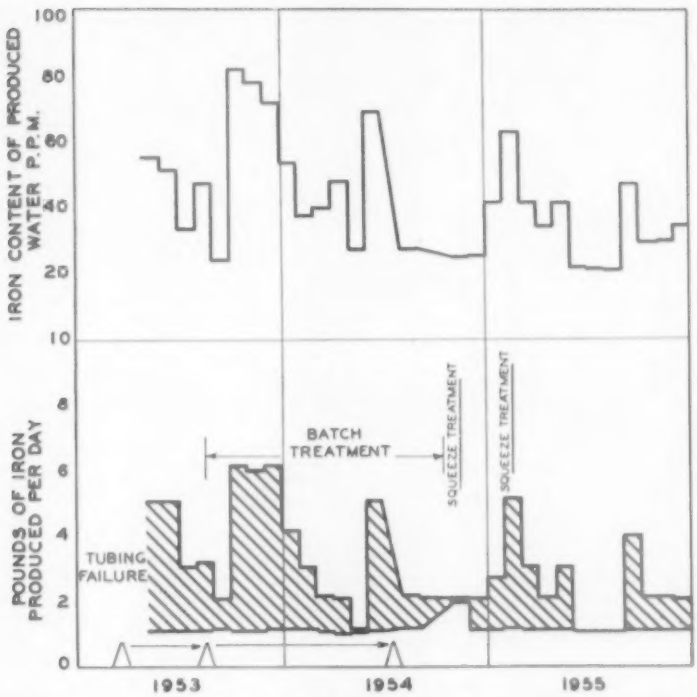
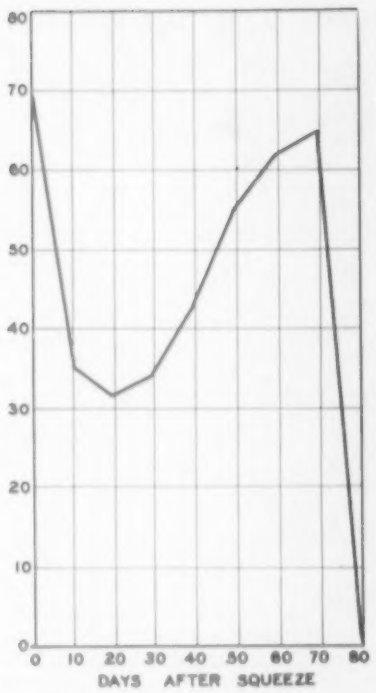


WELL NO. 1-S response to batch and squeeze application of inhibitor. Average produced iron declined from 2.49 to 0.69 lb. per day when squeeze treatment was started. Tubing life increased by 6 months. Fig. 1.



EFFECTIVENESS of squeeze treatment of Well No. 1-S was nearly 3 months as shown by above concentration of inhibitor in p.p.m. Fig. 2.

cal back into the formation will vary depending upon the sand and the chemical.

Results of squeezes . . . Eleven wells in the Greta formation have received one or more squeeze treatments. Production from two of the wells was changed. However, it is believed that in neither case was this completely due to the inhibitor squeeze. One well went to 100 per cent salt-water production after a squeeze. This is not an unusual thing in the field; several other wells have done the same thing, and they had received no treatment whatsoever. Therefore, it is believed that this inhibitor squeeze did not cause the change in this well's production. The other well had a change in production from 8 bbl. of oil and 85 bbl. of brine before treatment to 92 bbl. of oil and 550 bbl. of brine per day after treatment. This was probably caused either by a slight fracturing of the formation or a cleaning of the sand by the detergent effect of the chemical.

Two wells in the 5,500-ft. sand have been squeezed with inhibitor, and one of these wells was affected by the squeeze. For 3 days after the squeeze the well made only a very small amount of brine and no oil. However, in about 5 days the well returned to its normal production. The formation in this well is considerably tighter than the Greta formation and the bottom-hole pressure is quite low. Apparently a slight emulsion or water block was formed in the formation which prevented normal production until the emulsion broke or until the water forming the block was produced.

From this experience it has been decided that great care should be taken if or when a well with a low bottom-hole pressure and a fairly tight formation is to be squeezed with inhibitor. The other well in this 5,500-ft. sand has been squeezed using both oil and brine as a wash fluid behind the chemical without causing any change in the well's production.

Chemical losses . . . Some chemical is lost when the well is placed back on production and the amount will depend upon the type of chemical used, the adsorptive power of the chemical onto the sand, and the distance the chemical is forced into the formation. After the load water has been produced, the chemical content of the produced water will run between 100 and 200 p.p.m. for anywhere from 30 minutes to 2 hours, and then will go down to around 40 p.p.m. It has been calculated that anywhere from 1 to 10 gal. of chemical is lost, depending upon the factors mentioned previously.

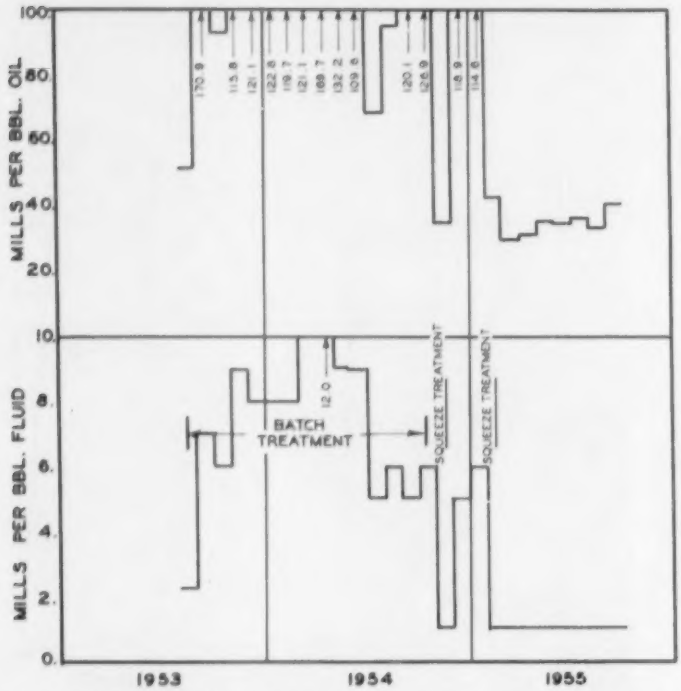
Another apparent loss of chemical occurs during the first squeeze. It is believed that some of the chemical that is adsorbed to the sand is never released into the fluid. The facts that indicate that this is true are: (1) large decrease in length of time of inhibition received when one-half drum or less of chemical is used; and (2) the second squeeze gives a longer inhibition life than the first.

Two wells were squeezed using only 27 gal. of chemical and the results of these wells showed that protection lasted for only a few weeks. Treatments using 55 gal. of chemical would last 3 months. In almost all instances the second squeeze was more effective and had a longer life than the first.

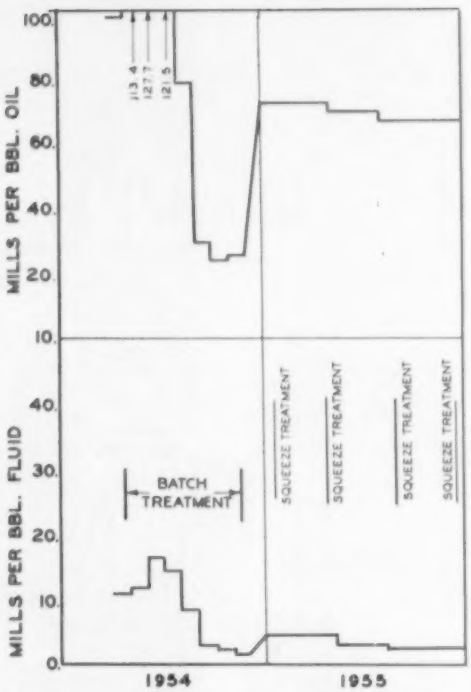
When one of these wells produces a large quantity of sand, as they quite frequently do, it is believed that a considerable amount of chemical is lost with this sand. Three wells that made large amounts of sand after squeezing did not give as good results as did those that made small amounts of sand.

Treatment Comparisons

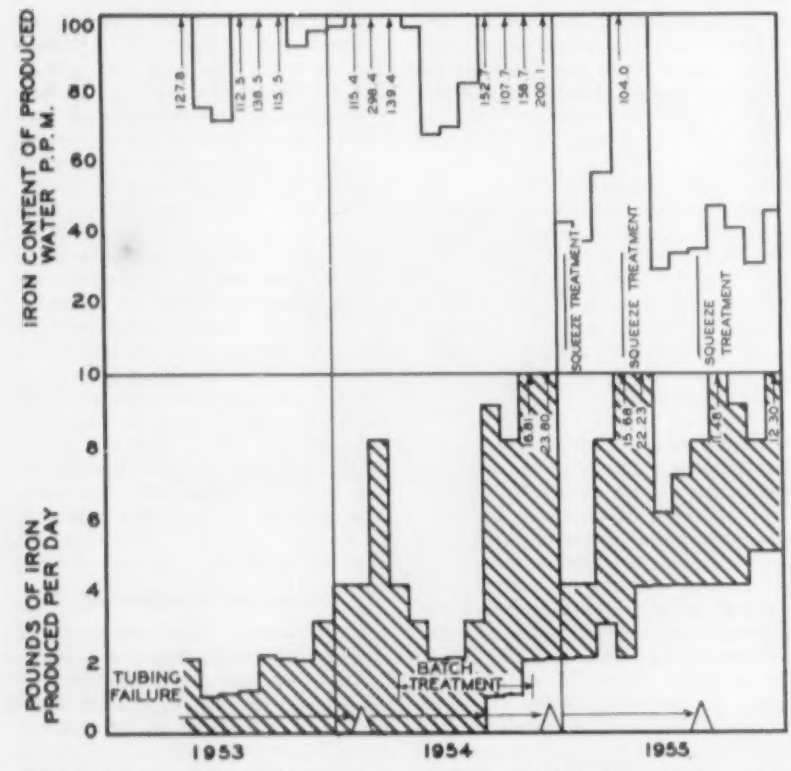
A comparison of batch treatment and squeeze treatment is shown in Table 1. Failures per year were calculated as follows: (1) the failures without treatment were calculated as the average over a 2-year period just prior to and/or just after batch treatment; (2) the failure rate during batch treatment was calculated as the average during batch



COST OF INHIBITION of Well No. 1-S decreased markedly with the beginning of squeeze treatments. Squeeze treatment cost only 41.9 per cent of batch treatment yet tubing life was at least 4 months longer. Fig. 3.



SQUEEZING was cheaper than batching for Well No. 2-S. Costs per barrel of fluid declined from 6.7 to 2.5 mills with treatments about 3 months apart. Fig. 5.



WELL NO. 2-S showed high-iron-content water until June 1955 because of filterable iron solids that were left in samples. After inhibitor treatment, tubing failures continued, but new pipe installed after squeezing started was undamaged at last workover. Fig. 4.

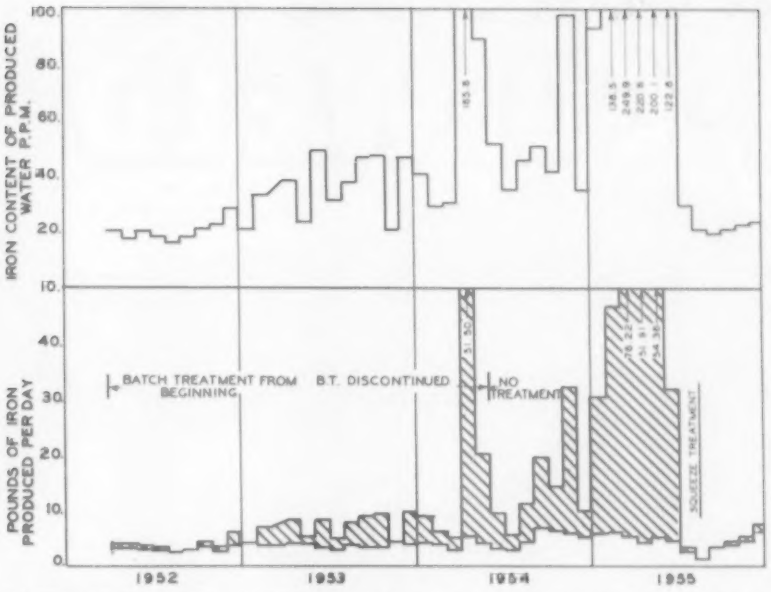
treatment. The length of time the wells were batch-treated varies from 3 years to 8 months; (3) the failure rate during squeeze treatment is the average as calculated from the beginning of the treatment to December 31, 1955, and varies from 3 to 14 months.

The net pounds of iron produced per day is the difference between the iron production, as calculated from iron content of the produced fluid, and the formation iron content. This net iron production takes into account the amount of fluid produced by the well. The iron content of the formation water has been derived from iron analysis of water produced from wells that have never had a tubing failure.

The treating efficiency was calculated from the reduction in net iron production.

Squeeze better . . . The seven wells that were treated by batch treatment had an average treating efficiency of 64.7 per cent. These same wells had an average treating efficiency by squeeze treatment of 81.6 per cent, or an increase of 16.9 per cent.

The treating cost for batch treatment averages 86.9 mills per barrel of oil produced and 3.69 mills per barrel of fluid produced. With squeeze treatment, the average treating cost for these same wells is 70.3 mills per barrel of oil produced and 1.85 mills per barrel of fluid produced. This shows a treat-



HIGHEST EFFICIENCY of inhibitor squeezing resulted in this record of iron production for Well No. 5-S. Declining protection from batch treatment was due to increasing water production. Fig. 6.

ing-cost reduction of 16.6 mills per barrel of oil or 1.84 mills per barrel of fluid by the squeeze method.

Iron analysis . . . Lack of correlation between net pounds of iron produced and failure rate brought about an investigation as to the cause of this poor correlation. After considerable investigation of water-sampling techniques and iron-analysis methods, it was found that the erratic results of the iron analysis was caused by produced sand.

When sand is visibly present in a sample, the iron is extremely high. But in many instances the sample will show high iron content with no visible evidence of sand. These wells frequently produce a very fine, light sand that is held in the oil phase and therefore is not visible.

Acidization of such samples for 12 to 24 hours usually yields high iron content. Thus it appears that erratic results were due to insoluble iron associated with the sand.

Filtered and nonfiltered samples were then taken for analysis. It was found that the filtered samples remain fairly constant in iron content, whereas the unfiltered samples are quite erratic. The iron content of the filtered samples is always equal to or less than that of the unfiltered samples. The unfiltered samples are almost the same as the filtered samples for a period of time, then suddenly the iron content becomes considerably greater than the filtered samples for a period of time. After this they come back down to the filtered-sample value.

The correlation between net iron production and failure rate is much better when calculated from iron content of filtered samples.

Specific Well Histories

Well No. 1-S. Prior to any chemical treatment the average iron content of the produced water from this well was 38.0 p.p.m. and the average net iron produced was 3.76 lb. per day (see Fig. 1). This well had had four failures in 12 months prior to treatment, or an average of one failure every 4 months.

Batch treatment was started in August 1953 using 1 gal. of chemical with 5 gal. of wash fluid daily which should give a chemical concentration of 85 p.p.m. After 10 months of treatment at this rate, a tubing failure occurred. The failure occurred at a depth of 3,200 ft.

This treatment extended the life of the tubing by 6 months. However, the iron content was not lowered any appreciable amount. Average iron count during treatment averaged 50 p.p.m.

Batch treatment was discontinued in October 1954 and the well was squeezed in November 1954 with 55 gal. of a water-soluble inhibitor followed by 30 bbl. of brine. The iron count was immediately lowered from 50 p.p.m. to 24 p.p.m., which resulted in a decrease in iron produced of 2.3 lb. per day. The iron content remained at about that level for 3 months and then went up quite rapidly to its original figure.

The chemical concentration, as shown in Fig. 2, was about 70 p.p.m. 3 days after squeezing and then declined to 0 p.p.m. in 3 months.

The well was then squeezed the second time in February 1955 with the same chemical but with 45 bbl. instead of 30 bbl. of brine. The iron content of the produced water did not decline as was expected. However, the well was making some sand and it is believed that this sand was causing the high iron counts.

To eliminate the sand, filters were placed on the well and the iron count of these filtered samples went down to 20 p.p.m. These iron counts remained at 20 p.p.m. until September 1955, at which time they began to go up to the present 28 p.p.m.

Since the first squeeze job the well has produced 98,480 bbl., or about 36.4 million pounds, of brine. The calculated average chemical content in the fluid is 24 p.p.m. Chemical analysis of the inhibitor in the well's fluid in November 1955 and December 1955 was 50.0 and 22.0 p.p.m., respectively. Fig. 2 shows the chemical content of the produced water for 3 months after the first squeeze.

The well has been produced for 14 months since the first squeeze without a tubing failure, which is an increase in tubing life over batch treatment of 4 months. Cost of treatment, shown in Fig. 3, averaged 120 mills per barrel of oil and 7.4 mills per barrel of fluid with batch treatment, whereas the cost by squeeze treatment was 69.2 mills per barrel of oil and 3.1 mills per barrel of fluid produced. The squeeze treatment cost 41.9 per cent of the batch treatment and has given a 4-month longer tubing life.

Well No. 2-S (Figs. 4 and 5). Analysis of the produced water from this well for iron content started in May 1953, and the average iron count in 1953 was 103 p.p.m. The pounds of iron produced per day in 1953 averaged 1.8. A caliper survey was run in January 1954 and the entire tubing string was found to be in very poor condition. The tubing was pulled in February 1954 and the entire string was replaced with new tubing.

Batch-type treatment started in February 1954. To start, sufficient chemical was used to give a concentration in the produced water of about 150 p.p.m. This treating ratio was continued for 2 months without giving much reduction in iron count. The chemical was then increased to about 200 p.p.m. concentration, and the amount of wash fluid used with the chemical was increased from 10 to 84 gal. This treatment lasted 2 months, and reduced the iron count from 96.0 to 66.0 p.p.m.

Wash water was reduced back to 10 gal. per treatment and the chemical concentration decreased gradually over

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5. Beth-Co-Weld comes in single mill lengths; also in double mill lengths up to 50 ft for sizes 1½ in. through 4½ in. OD.
6. Wide variety of ends: threaded and coupled; plain end beveled for welding; plain end square cut, grooved for ring joint coupling.

BETHLEHEM SUPPLY

a 4-month period to 20 p.p.m. Immediately after the reduction, the iron count began to rise until it reached a high of 158 p.p.m. in November 1954. In December 1954 the tubing failed.

A caliper survey of the tubing showed that 33 joints of the upper 50 joints were badly corroded, 18 of which had been penetrated completely. These 33 joints were replaced with new tubing. The well was squeezed in January 1955 with 55 gal. of chemical and 15 bbl. of brine in excess of the amount needed to displace the tubing contents.

Iron content of the produced water after squeezing averaged 42 p.p.m. with an iron production of 5 lb. per day. The iron count remained at about this level for 3 months and then went up to 104 p.p.m.

Another squeeze in the latter part of April 1955 lowered the iron content only a small amount, as shown in Fig. 5. Filtered samples were then taken and showed a large reduction in iron count. The iron count in June 1955 was 28 p.p.m. and the iron-production rate had decreased from 22 lb. per day to 6 lb. per day.

The well was squeezed for the third time in August 1955. Shortly after this squeeze the well was calipered and four joints were found with holes. However, the upper 33 joints, that had been installed new just prior to the first squeeze job, showed no evidence of damage by corrosion. The tubing was pulled and 40 joints of badly corroded tubing were replaced.

Treating costs are shown in Fig. 5. Average cost for batch treatment was 70.3 mills per barrel of oil and 6.7 mills per barrel of fluid. Cost of squeeze treatments averaged 63.1 mills per barrel of oil and 2.5 mills per barrel of fluid. The batch-treatment cost is chemical cost only and does not include necessary labor and equipment. The squeeze cost is made up of the cost of the chemical plus the cost of the labor and equipment used to perform the squeeze; however, it does not include the well's down time.

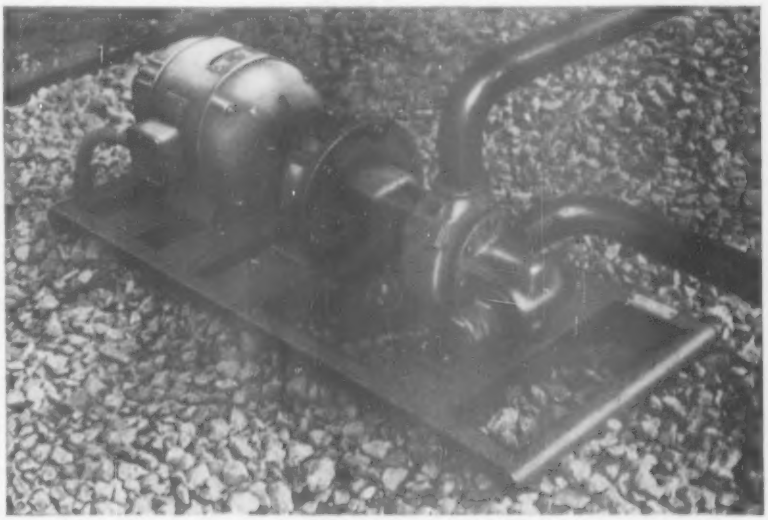
Well No. 5-S (Fig. 6). This well had several tubing failures in 1950 and 1951. Batch treatment with inhibitor was started in September 1951. Chemical treatment appeared to be quite effective. However, as the water percentages became greater and the corrosion more severe, the effectiveness of the chemical became less, as can be seen from the gradual increase in iron count and production, even though the chemical concentration of the produced water remained almost the same.

Batch treatment was discontinued in May 1954. The iron count went up to an average of 100 p.p.m. In August 1955 the well was squeezed with 55 gal. of chemical and 45 bbl. of brine. The iron count was immediately lowered to 20 p.p.m. and has remained near that value since.

Conclusion

Results that have been obtained from 11 wells indicate that the method of squeezing inhibitor into the formation is superior in efficiency and economy to the usual batch treatment for gas-lift wells in Placedo field. It is to be noted that this method is still in the experimental stage and considerable care should be taken in doing these squeeze jobs. At the present time we would certainly not recommend squeezing gas-condensate or low-fluid, low-water-productive wells. This program is being expanded to other wells producing from different sands and with different production characteristics, and in a year or so information concerning these wells will be available.

... **Further work** that has been suggested by these squeeze jobs is: (1) devise a laboratory method to evaluate the type of chemical that will give the best adsorption and desorption rate for a particular sand; (2) determine the optimum chemical to sand volume ratio; and (3) continue squeezing wells with varying sand characteristics and correlating them to laboratory results.



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What you ought to know about

Producing Dually Completed Wells

A new turned-down coupling for use on parallel strings offers new flexibility in operations for equipping wells to produce from dual zones. This and other important techniques for completing and equipping a dual-zone well are discussed here.

by J. Zaba, Henry Schaefer, and George E. O'Neal

Part 1

IF two zones are to be produced through one well bore without commingling of fluids, two conductors are needed which are entirely isolated from each other. Earliest methods of dual-zone conduction are flow through both tubing and casing annulus and flow through concentric tubing strings. These methods have serious disadvantages. The arrangement which overcomes the objections to these two methods is the use of two parallel strings of tubing.

In the first parallel-string installations, the two strings were run simultaneously. With equipment now available, each of the strings can be run separately. This offers considerable flexibility in handling the two zones.

. . . **Disadvantages** of parallel strings are: They are more expensive than the other two methods and a calculated risk must be taken of possible serious repair difficulties should failure occur.

But compare the following disadvantages of tubing and casing annulus flow:

1. The flow through the annulus, whether it is natural or induced by gas lift, is very inefficient. This is due to turbulence around the couplings of the inner string. In the case of natural flow, the flowing life of the zone producing through the annulus is therefore shortened. With gas lift, excessive gas-oil ratios occur.

2. If well fluids are corrosive, the possibility of damage to casing is quite real. A tubing string damaged by corrosion can be easily replaced. Repair of casing, however, is expensive and sometimes not possible.

3. Paraffin control in the annulus is always difficult and expensive.

4. The operator may not want to have the full pressure of the producing zone on the casing string.

The authors are with Stanolind Oil & Gas Co., Tulsa. Paper presented at A.P.I. Division of Production, Mid-Continent District, meeting at Wichita, under the original title, "Producing Dually Completed Wells."

PRODUCING

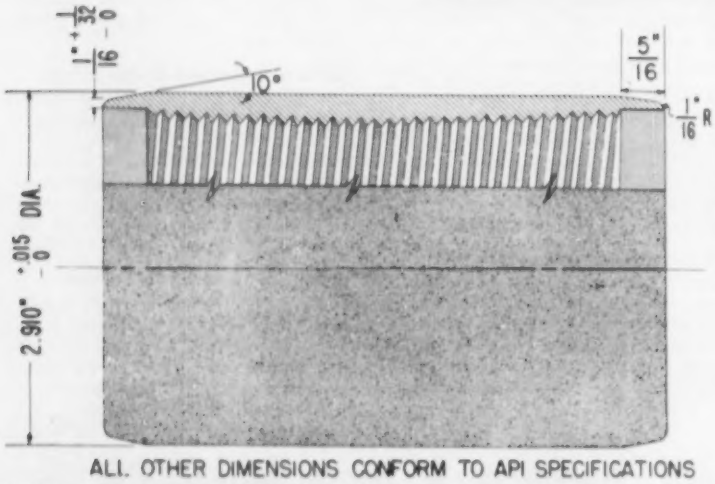
Concentric strings eliminate some of these objections but not all. They also present other problems, such as: (1) high frictional loss in the annulus between two tubing strings; (2) limitation on the amount of fluid which can be produced through small tubing; and (3) prevention of the running of wire-line tools in the large string.

Flowing Production

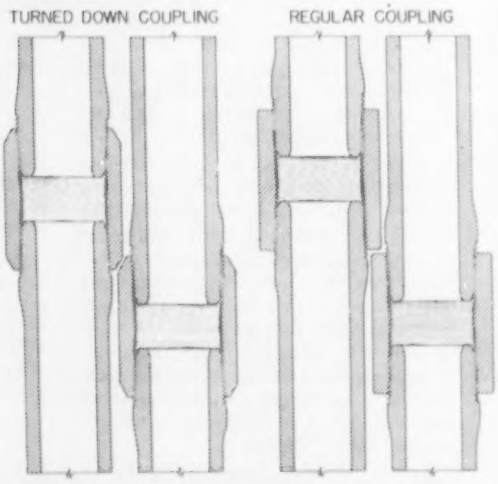
In completing a well for the flowing phase of its producing life, the following considerations are of primary importance. First, the equipment used must be such as to assure that the well is under complete control during completion operations and also later when any remedial operations have to be performed. Second, the arrangement should be such that at least some of the remedial operations can be performed on one zone without disturbing the other zone. Third, the changeover to artificial lift should be possible with a minimum of change in the original equipment.

Parallel tubing-string installations appear to fulfill most satisfactorily these three requirements and only the equipment used for such an installation will be here discussed. As far as packers and surface equipment are concerned, there is now such a variety of different types of this equipment commercially available that it can be discussed only briefly and only in most general terms.

Tubing . . . In parallel-string installations, the question of clearances is the



TURNED-DOWN TUBING COUPLING with decreased outside diameter and beveled edges allows two dual strings to slide past each other. Fig. 1.



DUAL STRING INTERFERENCE which occurs with regular couplings at right is eliminated. Strings at left can be separately pulled. Fig. 2.

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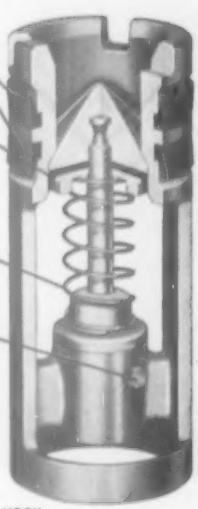

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primary consideration. Integral-joint tubing is generally used in one string and regular A.P.I. E.U.E. tubing in the other string. In seeking for a substitute for the integral joint for E.U.E. tubing, one operator tested and is using tubing with turned-down coupling on two strings of tubing. To February 15, 1956, this operator ran over 300,000 ft. of tubing equipped with such couplings in wells which ranged in depth from 4,000 to 12,000 ft. No difficulties have been encountered.

Standard 2⅜-in. N-80 tubing couplings for external-upset tubing have been turned to an outside diameter of 2.910-in. for use in running two strings of 2⅜-in. tubing in 7-in. casing. Fig. 1 shows dimensions of the coupling. Fig. 2 shows how the bevel on the shoulder prevents the couplings from interfering during running of the second string of tubing.

The cost of the turned-down coupling is about $3.75 each which includes the standard N-80 coupling, machine work, and a full electrogalvanized coat. Because the outside surface is machined, thus removing the "as-rolled" mill surface, it was deemed advisable to galvanize the coupling to retard corrosion. Consideration is being given to manufacturing the couplings from tubing having an outside diameter of 2.875 in. which is a standard roll size. In this event only the bevel edge and the threads would need protection from corrosion.

...Tensile tests of six turned-down N-80 couplings were made using both J-55 tubing and N-80 tubing. Results of these tests are as follows:

J-55 TUBING AND TURNED-DOWN N-80 COUPLING

Test No.	1	2	3
Tensile strength, lb.	124,240	148,660	146,320
Fracture	Tubing broke outside of coupling.	Tubing broke outside of coupling.	Test stopped because tubing walls collapsed in the testing machine grips. No failure in tubing or coupling.

N-80 TUBING AND TURNED-DOWN N-80 COUPLING

Test No.	4	5	6
Tensile strength, lb.	172,400	173,060	188,570
Fracture	Tubing broke outside of coupling.	Tubing broke outside of coupling.	Tubing broke outside of coupling.

As these tensile tests indicate, the turned-down coupling has adequate tensile strength.

Handling . . . Turned-down couplings require care in handling and installation to avoid unnecessary damage and to obtain satisfactory performance. All good practices for running and pulling tubing should be observed. Weight of the tubing string should not be carried on the end of the coupling because the bearing surface is narrow. For elevators either a type that supports the tubing on the upset or a slip type should be used.

Power tongs should be used for makeup and breakout in all cases. Experience indicates that a torque of about 1,200 ft.-lb. results in a satisfactory joint. Normally the two to four-thread makeup from the hand-tight position which is obtained with power tongs is satisfactory. When a joint fails to make up or over makes under full makeup torque, it should be removed from the tubing string.

A high-quality thread compound which has good lubricating properties should be used. The compound chosen should also be of a kind that will not set or dry out in the joint. All old compound should be cleaned from the threads and fresh compound applied before making up the joint.

Table 1 shows pertinent dimensions needed for determining the clearance available for running multiple strings of tubing in casing. Data on the turned-down N-80 coupling for 2⅜-in. external-upset tubing are included.

TABLE 1—TUBING

Nominal size and type—	Pipe o.d., in.	Lb. per ft.	Cplg. o.d., in.	Pipe i.d., in.	Pipe drift i.d., in.	Cplg. i.d., in.
1-in. integral joint	1.315	1.8	1.552	1.049	.955	.970
1-in. nonupset	1.315	1.7	1.660	1.049	.955	....
1-in. E.U.E.	1.315	1.8	1.900	1.049	.955	....
1¼-in. integral joint	1.660	2.4	1.883	1.380	1.286	1.300
1¼-in. nonupset	1.660	2.3	2.054	1.380	1.286	....
1¼-in. E.U.E.	1.660	2.4	2.200	1.380	1.286	....
1½-in. integral joint	1.900	2.9	2.113	1.610	1.516	1.530
1½-in. nonupset	1.900	2.75	2.200	1.610	1.516	....
1½-in. E.U.E.	1.900	2.9	2.500	1.610	1.516	....
2-in. integral joint	2.375	4.7	2.700	1.995	1.901	1.945
2-in. nonupset	2.375	4.6	2.875	1.995	1.901	....
2-in. E.U.E. turned-down cplg.	2.375	4.7	2.910	1.995	1.901	....
2-in. E.U.E.	2.375	4.7	3.063	1.995	1.901	....

TABLE 2—CASING

Casing o.d., in.	Lb. per ft.	Drift i.d., in.	Dual tubing string—collars pass: Tubing nominal size and type	Width across collars, in.	Clearance in csg., in.
5½	14	4.887	1½-in. nonupset	4.400	0.487
5½	23	4.545	1½-in. integral joint	4.226	0.319
7	26	6.151	2-in. E.U.E. turned coupling	5.820	0.331
7	38	5.795	2-in. integral joint	5.400	0.395
7	32	5.969	2-in. E.U.E. turned coupling	5.610	0.359

Table 2 shows the clearance available for several combinations of tubing in both 5½-in. and 7-in. casing. As an example, two strings of 2⅜-in. external-upset tubing with turned-down couplings can be run in 7-in. 26-lb. casing; the collars on the tubing will pass with 0.33-in. clearance.

Packers . . . One of the principal elements of the subsurface installation is a packer, permanently set in casing, which separates the two zones and permits the passage and removal of the longer string of tubing. A permanent-type packer now available for isolating the two zones can be set in the casing with wire line or by running in on tubing or drill pipe. A double set of slips is used so that packoff is obtained against pressure differential from either above or below the packer. The packoff is independent of setdown weight or tension.

The tubing string can be anchored to the packer or pass through it with a seal to prevent a pressure leak between the packer and the tubing. The tubing can be removed from the packer and isolation still retained between the producing zones, provided the lower zone has the higher pressure. A disadvantage of the permanent-type packer is that it cannot be removed from the hole, but must be drilled up.

Also available for a single-packer installation are packers of the removable type, either hook wall or anchor. They are run and pulled on the long string of tubing.

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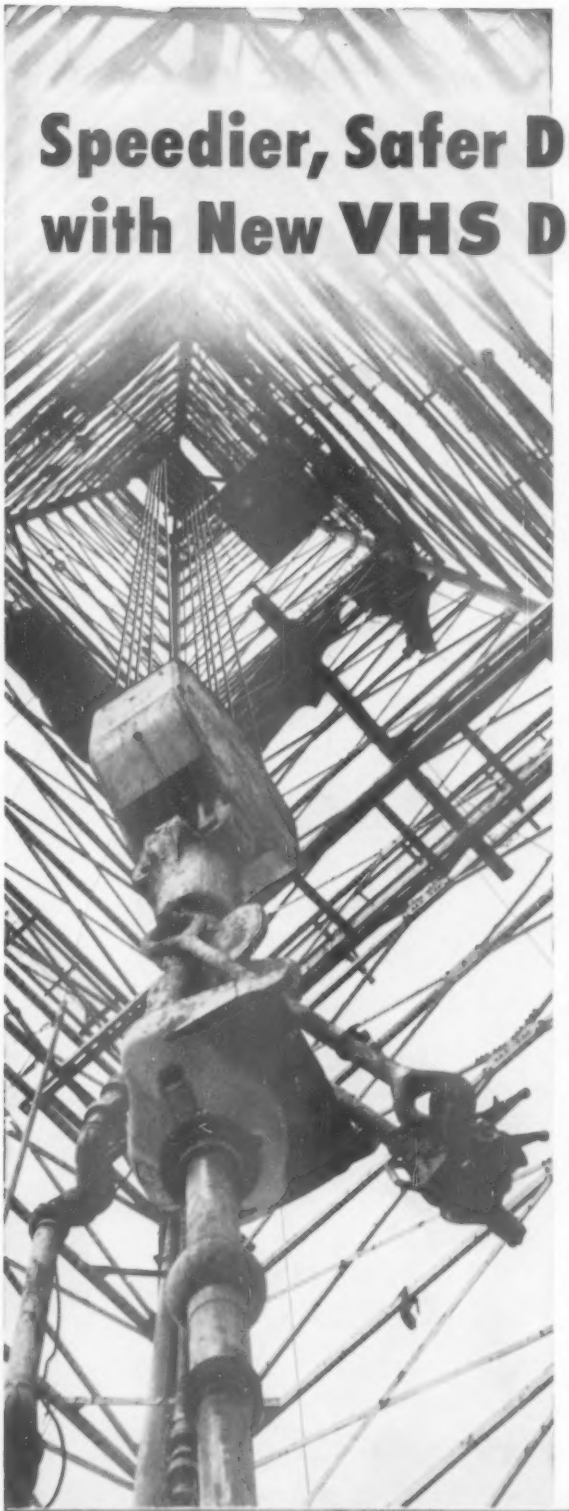

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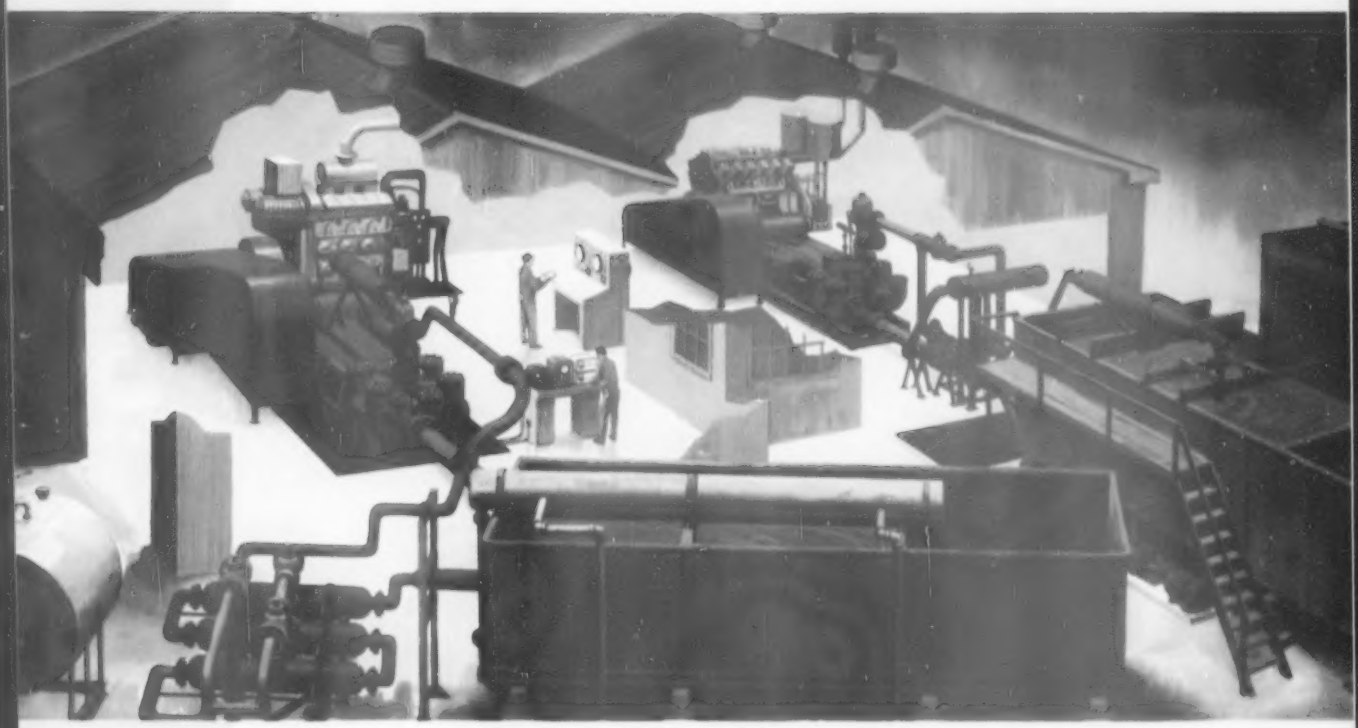

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No other pump parts manufacturer has such an advanced setup. These test pumps at the Mission main plant are fitted with the latest in electronic test instruments including a 14-channel recording oscillograph. This instrument is, to the Mission Research Engineer, what an electrocardiograph is to a doctor! Here, Mission research men conduct tests using a variety of contaminated or sand laden muds at temperatures that average 155°F and pressures that often exceed 2,000 psi. Without these test pump facilities, it would have been impossible to have developed the Mud Monarch Valve whose superiority has been proved in hundreds of field installations.

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HELIARC cutting, a new process developed by LINDE, brings all the desired features of economical high-speed operations to the cutting of aluminum.

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AMMONIA PLANT'S flow system was explained to Harry Bablak, Robert Gilchrist, Byron Todd, Donaldson Drummond, Robert Vanaman, John Dalton, and William Wetzel by Edward Tighe in Atlantic's compressor house.

At Atlantic's refinery . . .

Plant crew is trained before operations start

SCALE MODEL of Atlantic's ammonia-plant cold box is used by Stocton Snyder to explain process flow to John Bringman and William Beadle during class.

IN the startup of a new unit, one of the main problems is the proper training of the people to operate it. The chemicals department of Atlantic Refining Co.'s new Philadelphia refinery ammonia plant organized a carefully planned training program. This was first presented to shift foremen, who then trained 28 operators in the know-how of ammonia manufacture.

The training was accomplished by detailed job instruction, implemented by the use of models, diagrams, special manuals, and field investigation of every part of the unit.

The new plant, designed to produce 100 tons of ammonia per day and built by Hydrocarbon Research, Inc., uses hydrogen—a byproduct of Atlantic's catalytic reforming unit — and nitrogen extracted from the air.

INSTRUMENTATION is explained by George Hardy (pointing) to William Dudley, William Crossen, Alexander Perrone, Herbert Wheaton, and John Penrod.

MEASURING a sample from a leaky pump, Lucky Kuzenko (left) helps Bill Cassidy time the amount lost.

WHITE-CARDBOARD tickets with red lettering are attached to leaky pumps to remind division head of needed repairs.

Tickets mark leaky pumps

. . . At Esso Standard's Bayonne refinery

LEAKY pumps are a serious problem in the Bayonne refinery and a new program of "ticketing" leaks has been put into effect by Bill Cassidy, oil conservation head.

The only way to remove a pump ticket is to repair the leak, and Bill and his staff hand out the placards as a reminder that the pump involved needs repairs.

The program started recently and is part of the refinery's effort to cut down oil waste. Last June, the Refinery Loss Committee reported that oil losses averaged 508 bbl. per day through the first 6 months of 1955.

Cassidy's tickets are white cardboard with red lettering which glows in the dark. The top portion is attached to a leaking pump and information concerning the loss in barrels and dollars a day is written on this part. The bottom stub is detached and sent to the division head involved to inform him of the leak.

When leaks are repaired, the ticket is removed and sent to the division head and both portions are returned to oil conservation which makes a record of the proceeding.

Regular inspection . . . Regular inspection of all pumps in the yard is scheduled and the entire area will be checked.

When Cassidy or a member of his staff spots a leaking pump, he immediately measures and times the loss. This enables him to calculate the barrels and dollars lost in one day.

Leaks are the major item in oil loss according to the report of the Refinery Loss Committee last June. At that time, Jim Prescott, of P.E.D., reported that some 300 bbls. per day are lost through leaks.

"Some of this we never get back," he said. "In other cases we may reclaim some of the product but its value is lessened. A lube oil originally worth 40 cents a gallon may be worth only 6 cents when it's picked up."

PLACED over a pipe joint, the grasshopper acts as a two-wheeled dolly.

Grasshopper simplifies pipe handling

THE grasshopper can be used to allow one man to handle up to 1,000 lbs. of pipe on hard-surfaced roads or pavement.

It's really a two-wheeled dolly which is a poor cousin to the powered straddle-buggies used to handle heavy loads around a plant. The dolly is nothing more than two wheels that support a horizontal cross-member to which a long length of pipe, (the carrying bar) is welded at right angles. The cross-member is elevated above the wheels by two vertical extensions allowing the dolly to straddle large pipe without being limited to the axle height above the ground.

When moving a joint of pipe, the dolly is wheeled into position over the pipe and then tilted back so that a chain may be secured around the pipe and the end of the carrying bar. Once this is done, the dolly is tilted forward so the pipe also may be secured near the front of the carrying bar. In the process, the pipe on the ground first is elevated at one end. Then, when the dolly is raised back to a horizontal position, the pipe is raised with it and rides parallel to the carrying bar.

Method suggested by J. D. Rayburn, welder and Sammy Furo and Emon Flournoy, pipefitters. Courtesy Pan-Am Southern Corp. El Dorado, Ark.

by W. L. Nelson
Technical Editor

Correlating Octane Numbers of Plant Gasolines

What laboratory tests should I make in preparing a correlation by which I can estimate the properties of various plant blends of gasolines, using the end point, vapor pressure, octane number, amount of tetraethyl lead, etc., of the several blending stocks? J. G.

The blending of refinery gasoline stocks is so complicated that it is necessary to consult numerous references in the literature and especially the old issues of Questions on Technology. However, certain fundamental data will be needed:

1. Curves of end point versus octane number for each major blending stock (not for poly gasoline or butane-rich stocks which are presumed to remain substantially constant in their properties). The gasolines from each crude oil have somewhat different end-point curves but examples of such end point-octane number curves were published in "Octane Number versus Yield" (67 gasolines), *The Oil and Gas Journal, November 8, 1951, p. 332,* and "Effect of End Point on Octane Number" (including cracked gasolines), *The Oil and Gas Journal, January 7, 1952, p. 86.* All of the gasolines used in preparing such curves should be of the same vapor pressure (preferably 10 lb. R.v.p. but debutanized gasolines are also a good basis).

2. Lead-susceptibility data on each of the blending stocks. Typical susceptibilities were published in "How to Compute Octane Number of Blends," *The Oil and Gas Journal, September 19, 1955, p. 135,* but laboratory tests should be conducted by the refiner on his own stocks.

3. Vapor pressures of each of the blending stocks. One can get along fairly well with Reid vapor pressures on all of the blending stocks except the high-vapor-pressure butane-rich stock used for adjusting the vapor pressure. Its true vapor pressure must be determined because its Reid vapor pressure may be in error by 10 or occasionally even 50 per cent ("How Reid and True Vapor Pressures Vary," *The Oil and Gas Journal, June 21, 1954, p. 179*).

4. Blending octane numbers on various combinations of blending stocks. One can assume or estimate these from such information as that in "How to Compute Octane Number of Blends," *The Oil and Gas Journal, September 19, 1955, p. 135,* but again, each set of refinery blending stocks has its own behavior and accordingly, a few sample blends should be prepared at low and at high concentration and tested for octane number to determine the exact relationship. A multiplier factor can be computed by such tests as follows:

$$N = \frac{CP_bN_b + PN_a}{100}$$

in which:

N = octane number of blend
P_b = volumetric percentage of blending agent
P = volumetric percentage of base stock
N_b = octane number of blending agent (clear or leaded)
N_a = octane number of base stock (clear or blended)
C = factor by which N_b is multiplied to obtain its blending octane number or behavior in the blend

Each concentration and each pair of blending stocks requires a different value of "C," and accordingly curves of "C" are necessary for each pair of stocks.

In using all of the above, the procedure is as follows:

(a) Compute the amount of butane-rich blending stock that will be required to convert the vapor pressure of the standard curves to that of the desired plant blend, using true vapor pressure for at least the butane-rich agent.

(b) Compute the octane number of the mixture of the straightrun and all of the butane-rich material that will be used. Use just the regular laboratory octane numbers.

(c) Determine the leaded octane number of each of the materials used in the blend for the amount of tetraethyl lead expected in the final blend. This may necessitate a repeat computation if the assumed TEL content is found later to be wrong.

(d) Compute the octane number of the final blend using the leaded octane number of the straightrun butane mix and the leaded blending octane number of the cracked gasoline, as in the equation given herein. If several cracked and poly stocks are used, these are blended together first using an appropriate value of "C" and then the entire cracked material is blended with the straightrun butane mix.

This is not an altogether satisfactory answer, but such blending operations are so complicated that the reader must be patient in looking up the numerous references.

Polymerization During The Winter Months

How can we make less poly gasoline in the winter when we need the vapor pressure of our butylenes? Wm. G. P.

Although basic polymerization theory indicates that higher reaction chamber temperatures in phosphoric acid plants would result in slightly larger conversions of propylene in relation to the conversion of butylenes, this is probably of little significance. All that can be done in a practical way is to operate the cracked-gasoline stabilizer at a higher pressure so that propane (propylene) will be the primary stabilizer overhead product rather than butanes (butenes). Thus, the butylenes will be retained to a greater extent in the stabilized gasoline rather than going as stabilizer "tops" to the polymerization plant. This may be impossible because most gasoline stabilizers are built for debutanization pressures (70-120 psi.) whereas depropanization requires at least 225 psi. and a pressure of 300 psi. is even more suitable.

In phosphoric acid polymerization the order of "ease of polymerization" is:

isobutylene
β butylene
α butylene
propylene
ethylene (scarcely reacts)

The reverse is true in thermal polymerization plants, i.e., ethylene is the most reactive. However, few if any thermal plants are now in operation.

Industrial Power Cycles for Oil-Industry Use—4

by Stephen Bencze

THE simple noncondensing cycle is probably the most widely used in industrial applications. Where large quantities of steam at fixed pressure are required for industrial purposes or where water for condensing purposes is limited or unavailable, this cycle has wide application.

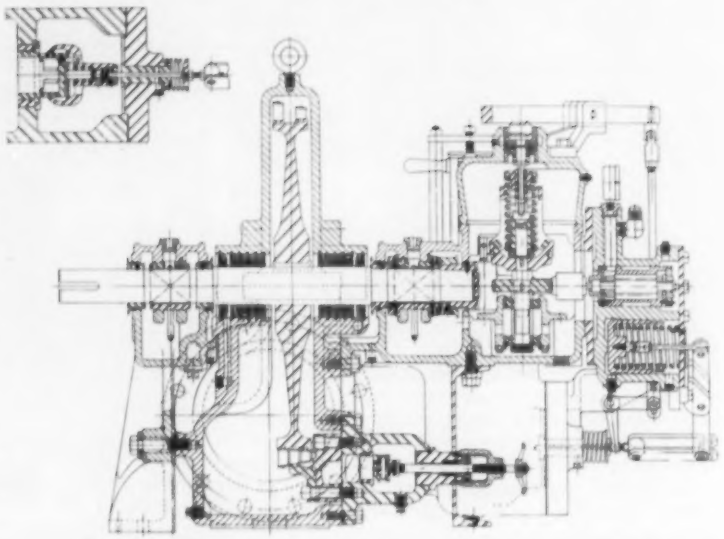
Unlike the full-condensing turbine, the noncondensing turbine is not penalized by heat lost to condenser circulating water because the exhaust steam is used for process. Thus power is produced at a very low cost. If all exhaust steam is used, this cycle will produce power at the lowest possible cost assuming that capital investment charges are not excessive.

Because of this, and particularly when power and steam requirements are nearly balanced, this cycle is used extensively. The advantages of this type of plant is not only a less-expensive turbine but also the elimination of all of the condensing equipment.

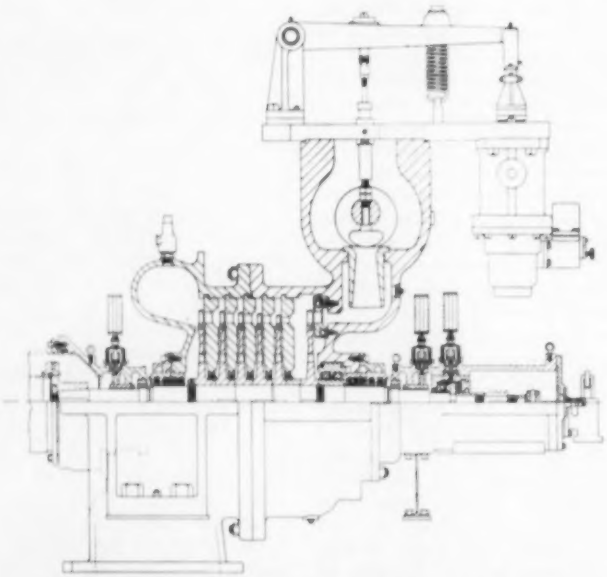
Small turbines for auxiliary drives are usually noncondensing. They exhaust at atmospheric or slightly higher pressure for process or into deaerating feed-water heaters or to a heating system. In many cases, these turbines are also used as standby or quick starting emergency units.

Fig. 5 shows the cross-section of a typical small noncondensing single-stage mechanical-drive turbine used for driving usual auxiliaries. Fig. 6 shows the cross-section of a typical multistage, noncondensing, mechanical-drive, industrial-type turbine. This unit is rated at 3,500 hp. at 3,625 r.p.m. with steam at 170 psig., 450° F., 30 psig. operating pressure.

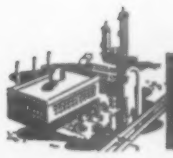
In recent years, the superposed or "topping" turbine has found considerable favor. These "Toppers," as they are usually called, operate at exhaust pressures considerably higher than atmospheric. Generally relatively high efficiency is required, therefore these turbines are generally of the multistage type. Small single-stage Topper of a much simpler design are also available. They are used for less-exacting steam conditions for driving auxiliary equipment.



NONCONDENSING single-stage turbine for auxiliary drives. Fig. 5.



NONCONDENSING multistage mechanical-drive turbine. Fig. 6.



JOB IMPROVEMENT FOR THE PROCESS FOREMAN—57

Fractional Distillation Allows Liquid Separation

WHEN attempts are made to boil off a light liquid from a heavy liquid, some of the heavy liquid also vaporizes. However, the vapor attained always will be richer in the light component. This property enables liquids to be separated by fractional distillation.

Equipment

The equipment used in distillation operations is selected in accordance with the desired separation. The simplest form being the batch operations carried out in shell stills.

Shell still . . . The shell still produces products which contain a substantial amount of overlap between products—i.e., gasoline in the kerosine fraction, and kerosine in the gasoline fraction. To reduce this overlap, multiple distillations were employed, where the still was charged with gasoline and redistilled to a bottom of kerosine. The same procedure of redistillation is carried out to further reduce the overlap. This multiple-type distillation is known today as fractional distillation.

Column function . . . The separation of products by fractional distillation may be pictured as consisting of a series of stills as shown in Fig. 1.

Suppose that the first still contains a liquid mixture of gas oil and residuum; the second still, a mixture of kerosine and gas oil; the third still a mixture of naphtha and kerosine; and the fourth still, a mixture of gasoline and naphtha.

The liquid mixture in the first still boils at 650°F., that in the second at 500°F., that in the third at 375°F., and that in the fourth at 275°F. Upon the application of heat, the vapors formed by partial vaporization of the liquid in the first still will be at a temperature of 650°F. This vapor is then allowed to bubble into the liquid in the second still which boils at 500°F. The vapors from the first still are condensed then by the cooler liquid in the second still.

The latent heat, thus obtained, causes partial vaporization of the kerosine fraction in the second still. At the same time, the liquid residue from the second, now reduced in kerosine content, is allowed to flow into the first still, thereby enriching it again in gas oil. Simultaneously, the kerosine-fraction vapors from the second still are allowed to bubble into the third still containing kerosine and naphtha. These vapors, at the boiling point 500° F., will condense and give up their heat, thereby supplying heat to vaporize the naphtha-boiling-range fraction.

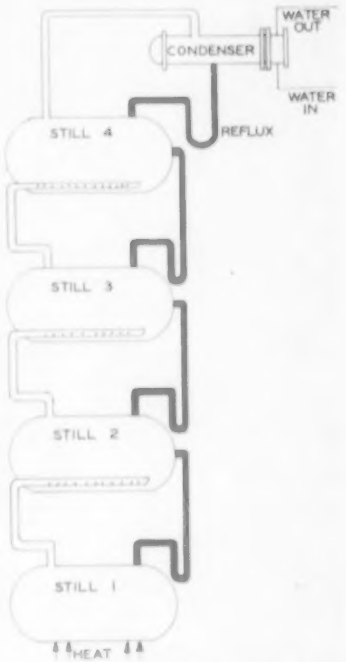
By such successive steps, supplying heat to the first still only, the vapors from each still in the series are progressively enriched in the lower boiling-range fractions until only gasoline passes from the fourth still into the final condenser. If there has been no heat loss due to radiation from the series of stills, the amount of heat obtained by condensing the gasoline will be equal exactly to that supplied to the first still.

To maintain these conditions, it would be necessary to return all of the gasoline condensed to the fourth still so that the proper amount of liquid flows back to the preceding still and so on down the line.

Requisite conditions . . . Certain factors are essential for the conditions of fractional distillation:

1. The vapors rising from each still must be in equilibrium or balance with the liquid in that still.

2. The liquid flowing from each still must be equal, in the amount and boiling range, to the vapors flowing into that still.

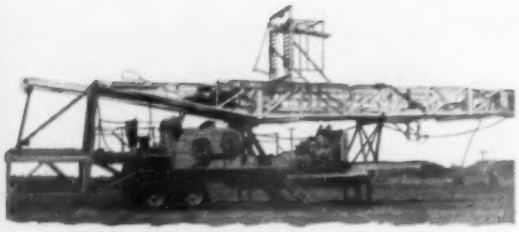


A SERIES OF STILLS is used for separation of products by fractional distillation. Fig. 1.

3. There is no addition or loss of heat in the system except the introduction of heat into the first still and the removal of exactly the same amount of heat in the condensation of gasoline into the final condenser.

The practical application of this method of enrichment of vapors in lower-boiling-range fractions involves some modification of theory. Obviously, the purpose of such a process is to separate one component from another or various boiling-range fractions from other higher-boiling-range fractions. Therefore, all the gasoline cannot be returned to the last still. By taking off a portion of the gasoline and returning another portion as reflux, it is possible to make use of the process for the desired separations.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.



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Drilling Contractors

Rocky Mountain Drillers To Meet In Conferences

Leaders of the oil well drilling industry in the Rocky Mountain area will meet in conferences at Denver, Colo., and Casper, Wyo., during July and August to exchange views on economic and management aspects of the industry.

The first meeting will be held July 25-27 at the Gladstone Hotel in Casper, according to Brad Mills, executive vice president of the American Association of Oilwell Drilling Contractors, sponsor. Ray Sing, Bighorn Drilling Co., Casper, is in charge of local arrangements.

The Denver conference for drilling executives is tentatively scheduled for August 8-9-10. Local chairman is Will I. Lewis, Jr., of Will I. Lewis Drilling Co., Denver.

M. L. Powers, University of Oklahoma industrial training specialist, will serve as coordinator for the conferences. Powers will also conduct the sessions on management organization and supervision.

A forum of realistic bidding practices will be led by E. H. Sloyer, R. W. Rine Drilling Co., Wichita, Kans. Other subjects to be discussed at the meetings include channels of communication for obtaining bidding information, and management's selling job.

Conference programs are being arranged by the Petroleum Extension Service of the University of Texas.

The Rocky Mountain meetings will be patterned along the lines of the successful Conference for Drilling Executives held earlier in Dallas, Mills said. Similar meetings are also planned for other active oil well drilling areas. Plans are now being made for a conference in Tulsa this fall.

Loffland Brothers Co., Tulsa, got Pure Oil Co.'s contract for a 13,500-ft. test to be drilled in the Creole area, in the Gulf of Mexico, just off the coast of Cameron Parish, southwestern Louisiana. It will be Pure's 1-A State Lease 2760. Deepest production at Creole, opened in 1938 as Louisiana's first field in the Gulf of Mexico, is in a 6,900-ft. sand.

Exploration Drilling Co., Tulsa, has a new deep wildcat job in San Pete County, Utah. It is a 10,500-ft. test for Colorado Interstate Gas Co. Location, at 1 Jensen, in 16-14s-5e, about 10 miles west of Gordon Creek and Clear Creek fields, and about 30 miles west of Price.

Strain Drilling Co., Denver, is drilling for Colorado Western Exploration Co. at a wildcat location 15 miles northeast of Chappell, in eastern Deuel County, southwestern Nebraska. Location, at 1 Pfeiffer, in 25-14n-43w, is about 2 miles northwest of the Big Springs area.

Jett Drilling Co., Shreveport, has a new wildcat operation 3 miles north of Newellton, in Tensas Parish, East-Central Louisiana. It is an 8,500-ft. lower Tuscaloosa test for F. H. Shortridge, of Jackson, and Joe P. Tischner, of Natchez, Miss. The test is carried as 1 Panola, with location in 15-13n-12e.

Maxwell Herring Drilling Corp. has a rig working on a new wildcat operation 2½ miles southeast of Jarvis, in Anderson County, East Texas. It is a 5,500-ft. Woodbine test for Oil Properties, Inc., of Dallas, at 1 Fisher, in the Swanson Yarbrough Survey. This contractor also is starting a 4,500-ft. Woodbine test for Russell Cobb, Jr., at a wildcat location, 1 Harwell estate, in the Henry Jeffries Survey, 15 miles southeast of Trinidad, in Henderson County.

South States Drilling Co. is contractor for F. R. Jackson and John C. Robbins 1 J. C. Minor, a Rusk County, East Texas, wildcat to test to 7,600 ft. Location is 12 miles west of Tatum on the Jesse Walling Survey.

Bickerstaff & Tibbit Drilling Co. have a 4,000-ft. contract for J. R. Cone 5 Nix-State in Jalmat field, Lea County, Southeast New Mexico. Location of the new well is 13-22-35. They will also drill the 6 Nix-State in 13-22-35, another 4,000-ft. test.

Atlas Drilling Co. has contract for F. A. Callery, Inc. 3 Hibernia Bank & Trust Co. in Liquidation, a Laurel Ridge area test in Iberville Parish, South Louisiana. The well will be taken down to 11,000 ft.

Vincent & Welch et al 1 Cifroy Roy will be drilled by **Circle Drilling Co.**

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in 14-8s-1w, Grand Coulee area. Acadia Parish, South Louisiana. The projected depth of the test is 10,400 ft. Circle also has contract for the 1 Lester Reed Unit, a Vincent & Welch, Inc. and George C. McGhee well in 13-8s-1w, also in the Grand Coulee area.

Clegg & Hunt are contractors for a Frio sand wildcat in Acadia Parish, South Louisiana. The wildcat will be the Columbian Carbon Co. 1 L. C. Desorneaux, 61-10s-2w.

B. F. Allison is contractor for R. W. McDowell, Jr. 1 Gannon, C NW NW 32-13n-57w, 2 miles west of Chaney in Kimball County, western Nebraska. He also has the contract for the 1 Christoferson, another Kimball County test in C SE SW 14-13n-58w. This one is 2 miles southeast of McDowell pool.

Dan L. Clark is contractor for a 7,200-ft. Agua Dulce area test in Nueces County, Texas. The well will be drilled for Northern Pump Co. at 2 W. C. Ocker on the 115.2-acre lease Partition of Wright Lands, Vincent Lopez de Herrera Grant, 6 miles north of Banquete.

Carter-Jones Drilling Co. is contractor for a Cherokee County wildcat in East Texas. The well will be known as the Bobby Manziel 1 W. B. Rogers on the F. G. Timmins Survey, A-664. Location is 4½ miles southeast of Rusk.

Golden Meadow Well Service Co. has contract for a Shell Oil Co. well in Main Pass Block 69, Plaquemines Parish, South Louisiana. The 10 State Lease 1357 will go to 8,100 ft.

Gary Drilling Co., Oil City, has contract for a Clifford area wildcat in northern Webster Parish, North Louisiana, for M. C. Burnham of Cullen, La. The 3,200-ft. Tokio test is ¾-mile northeast of Clifford. It will be the 1 Babe Flournoy et al, 19-23n-10w, 1 mile southeast of Springhill. It is also 3⅝-mile southwest of North Shongaloo field.

Wytex has contract for a wildcat in Elbert County, Colorado, for R. E. Hibbert 1 R. L. Murdock, located in C SE NW 17-8s-62w. Location is 14 miles southwest of Bradbury, Colo.

Gulf Coast Drilling Co. has contract for a 11,500-ft. test in Plaquemines Parish, South Louisiana. Drilling will be done for Shell Oil Co.'s 4 State Lease 2675 in the South Pass Block 20 area.

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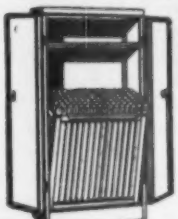

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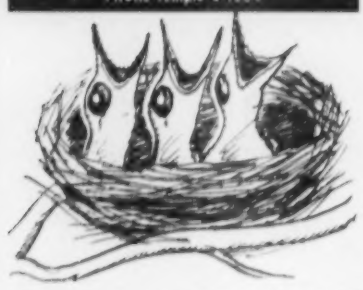

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Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

DIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by ● preceding the project.

Crude-Oil Pipelines

Buckeye Pipe Line Co.—Will complete in October or November 1956, own reconditioning of 191 miles of 8-in. from Griffity, Ind., to Lima, Ohio.

● **Gulf Oil Corp.**—Will build 33 miles of 8-in. from Citronelle field to Mobile, Ala., to be completed late summer 1956.

Lakehead Pipe Line Co., Inc.—Anderson Brothers Corp. has under way 51 miles of 26-in. looping from Viking to Plummer, Minn., to complete August 31, 1956. It is in conjunction with 69 miles of 24 and 26-in. to be completed this summer by Interprovincial Pipe Line Co. (See Interprovincial, foreign crude.)

● **Magnolia Pipe Line Co.**—Plans 36 miles of 12-in. from Andrews to Midland, Tex., to be completed January 1, 1957.

● **Offshore Gathering Corp., Houston.**—Proposes 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana.

● **Pasotex Pipe Line Co.**—Plans 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section, to complete July 31, 1957.

● **Shannon Oil Co., Denver.**—Plans with Farmers Union Central Exchange, Inc., and Mule Creek Oil Co., both of Billings, Mont., a 34-mile, 6-in. line from Murphy Dome in Hot Springs County, Wyoming, to contact Ohio Oil Co.'s line in Big Horn County. Construction to start in August, end by December 1, 1956.

● **Sinclair Pipe Line Co.**—Plans 150 miles of 20-in. from Teague, Tex., to Houston.

● **Tecumseh Pipe Line System.**—190 miles of 20-in. will be built by Sinclair Refining Co., Pure Oil Co., Ashland Oil & Refining Co., between East Chicago and Cygnet, Ohio, to be completed September 1957.

● **Union Oil Co. of California.**—Proposes 415-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.

Will build 225 miles of 16-in. from San Joaquin Valley to its refinery at Oleum, Calif., to be completed late 1957.

Products Pipelines

● **American Pipe Line Co.**—Received ODM approval to amortize 40 per cent of $178,000,000 with a rapid writeoff on proposed line from Gulf Coast area to New York City area.

● **Cities Service Oil Co. & Subsidiaries.**—Plans a 10-mile, 6-in. L.P.G. line from Maysville to near Pauls Valley, Okla., to tie in to Shell line moving on to Cushing, Okla.

● **El Paso Natural Gas Co.**—Plans 240 miles of "larger than 6-in." to carry natural gasoline, butane, and propane, from its Midcliff natural-gasoline plant in Permian basin, Midland County, to El Paso. Has under way 96 miles of 8-in. in New Mexico, from its Blanco plant to its Wingate plant.

● **Gulf Refining Co.**—Will build 45 miles of 8-in. from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss. (due on stream May 1957) to a connection with Plantation Pipe Line Co.'s system. No date set to start.

Inland Corp.—Sheehan Pipeline Construction Co. has under way 33 miles of 10-in., from Mogadore to Cleveland, Ohio, to complete July 15, 1956.

Magnolia Pipe Line Co.—Plans a 30-mile, 8-in. line from Andrews to Dollarhide, Tex., to complete January 1, 1957, and an L.P.G. line, 19 miles of 6-in., 3 miles of 4-in. from Beaumont to Orange, Tex. Brown & Root has under way a 75-mile, 8-in. L.P.G. line from Hull to Texas City, Tex., to complete January 1, 1957.

● **Phillips Chemical Co.**—Plans 79 miles of 6-4-in. ethylene line from Sweeny to Pasadena, Tex., to be completed December 31, 1956.

● **Phillips Petroleum Co.**—Plans 15 miles of 6-in. L.P.G. line in Sweeny, Tex., area, to be completed September 15, 1956.

● **Phillips Pipe Line Co.**—Plans 135 miles of 12-in. looping between Borger, Tex., and St. Louis, Mo., to be completed December 31, 1956.

Plantation Pipe Line Co.—Oklahoma Pipe Line Constructors has under way 327 miles of 18-in. from Baton Rouge to Helena, Ala., to complete December 1956, N. L. Arie, spread man, office at Baton Rouge.

● **Shell Oil Co., Pipe Line Department, Pacific Coast.**—Plans to convert 13 miles of existing 4-in. gasoline line, and add 3 miles of new line, to move gasoline from Wilmington refinery to Los Angeles. To be completed January 1, 1957.

● **Sioux Oil Co.**—Plans 80 miles of 4-in. from its Newcastle, Wyo., refinery to Rapid City, S. D., to be completed late 1956.

● **Sohio Petroleum Co.**—Plans 37 miles of 8-in. from Mogadore to Girard, Ohio, to complete November 1, 1956.

● **Southern Pacific Pipe Lines, Inc.**—Plans a 300-mile line to span the Sierras and connect San Francisco with Reno and Fallon, Nev., and to serve the Sacramento Valley.

Sun Pipe Line Co.—Contracts let on 109 miles of 14-in. from Twin Oaks, Pa., to Newark, N. J.: Sheehan Pipe Line Construction, 90 miles from Twin Oaks to Plainfield, N. J., J. W. Brown, spreadman, office at Malvern, Pa.; Delaney-Missouri Valley Construction Co., remainder. Missouri Valley Dredging Co. has river crossings at Delaware, Schuykill, and Raritan rivers. Work started May 1, to end September 1956. Line replaces present 8-in. line.

● **Sunflower Pipe Line System.**—Has Kansas Corporation Commission approval for 215 miles of 6-in. to move L.P.G. from six counties in western Kansas to Wichita.

Non-Petroleum Pipelines

● **American Gilsonite Co.**—Plans 70 miles of 6-in. from Bonanza, Utah, to Grand Junction, Colo., to carry slurry of gilsonite from mines to refinery now being built.

Pittsburgh Consolidated Coal Co.—Let to Williams Brothers, 108 miles of 10-in. from

Pipeline Patrol

its mines in eastern Ohio to Cleveland Electric Illuminating Co.'s Eastlake power plant northeast of Cleveland. Work started April 1, 1956, on this first line to move coal, with Ford, Bacon & Davis, Inc., handling specifications, contracts, construction supervision.

Natural-Gas Pipelines

American Louisiana Pipe Line Co.—Let bulk of 1,160-mile line from North Tepetate, La., to Detroit. H. C. Price and Houston Contracting Co. have 770 miles of 30-in. from near Willow Run, Mich., to near Eudora, Ark.

Houston started June 1 on 40 miles in Ohio, E. C. Norris, spread superintendent, office at Defiance; started May 1 and has completed 28 miles of a 100-mile section from east of Memphis, Tenn., working south toward Eudora, Ark., W. H. Hayes, spread superintendent, office at Senatobia, Miss.; started May 15 and has completed 17 miles of an 85-mile section working north from Eudora, F. A. Silar, spread superintendent, office at Greenville, Miss. Houston's work to be completed early August 1956.

Price starts May 1 on 83 miles in Tennessee, R. L. Ezell, spread superintendent, office at Brownsville, Tenn.; 31 miles in Indiana, C. E. Shivel, spread superintendent, office at French Lick, Ind.; 83 miles in Kentucky, C. R. Ice, spread superintendent, office at Princeton, Ky.; 31 miles in Indiana, W. H. Olrich, spread superintendent, office at Edinburg, Ind.

Brown & Root has 221 miles of 30-in. from North Tepetate to Arkansas-Louisiana border (which is subcontracted to Associated Pipe Line Contractors and Western Contractors), and 39 miles of 16-in. under-water line which it will lay itself. Western Contractors expects to complete its 100 miles August 1956. W. B. Williams, spread man, office at Eunice.

Houston Contracting Co. and H. C. Price Co. will start early August 1956 on 121 miles of 22-in. from Payne, Ohio, to Bridgman, Mich. Houston will lay 75 miles on eastern section, E. C. Norris, spread man; Price will lay 46 miles on the west. Work to end fall 1956.

Plans 21 miles of 24-in. from Tepetate to Lewisburg, La., starting July 15, ending summer 1956.

• **Arkansas Louisiana Gas Co.**—Has long-range plans for line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.

Atlantic Seaboard Corp.—Williams-Austin Co. has under way 50 miles of 24-in. from Hardy County, West Virginia, to Greene County, Virginia, O. L. Martin, spread man, office at Elkton, Va., and 32 miles of 26-in. loops along the Cobb-Rockville line in West Virginia. Ralph Gaddy, spread man, office at Elkins, W. Va., both to be completed November 1, 1956.

• **Carolina Pipeline Co.**—Applied for South Carolina Public Service Commission permit to distribute gas in central South Carolina. Plans lines to 14 cities. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.

Cascade Natural Gas Co.—Engineering Construction Co. started April 1, 1956, laying 400 miles of ¾ to 12-in. distribution lines in Yakima, Grandview, Granger, Trosper, Sunnyside, Toppenish, Union Gas, Wahpato, and Zillah, Wash., to complete August 1, 1956, Jim Harty and Jim Underwood, spread men, office at Yakima.

• **Cities Service Gas Co.**—Plans 12 miles of 30-in. and 17 miles of 20-in. between Oklahoma City and Mulhall, Okla., to be completed October 1, 1956.

Prairie Construction Co., Inc., has 28 miles of 16-in. between Leavenworth, Kans., and St. Joseph, Mo., to complete August 15, 1956; 9 miles of 16-in. near Springfield, Mo., to complete October 1, 1956; 4 miles of 12-in. from Johnson County to Lafayette County, Missouri, to complete September 1, 1956.

J. E. Carlson Construction Co. has under way 7 miles of 10-in. near North Topeka, Kans., to complete July 15, 1956.

• **Coastal Transmission Corp.**—Applied to FPC for 565 miles of 22-26-in. from McAllen, Tex., to Baton Rouge, to deliver to Houston Texas Gas & Oil Co.'s proposed line to Florida. Plans 272 miles of smaller gathering lines.

• **Colonial Natural Gas Corp.**—Proposes two systems: One between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.

• **Colorado Interstate Gas Co.**—R. H. Fulton has 238 miles of 22-in. from Laramie to Green River, Wyo. (last part of a 374-mile line between Denver and Rock Springs), to be completed fall 1956. Filed, March 29, for FPC permit for 1957 program: 307 miles of 30-in. from Idalia, Colo., to Beatrice, Neb., to take gas from a planned 165-mile, 26-in. line from near Carr, Colo., to Idalia, and from a 72-mile, 26-in. line from near Kit Carson, Colo. to Idalia; 215 miles of 20 and 24-in. to parallel present line from Texas Panhandle area to Kit Carson; 34 miles of 16-in. from Keyes field, Oklahoma, and Greenwood field, Kansas, to the new north-south line.

• **Colorado-Wyoming Gas Co.**—Plans 11 miles of 16-in., 2 miles of 12-in., and 2 miles of 8-in. looping north of Denver, to be completed November 1956.

• **Crown Central Pipe Line Co.**—Plans 6

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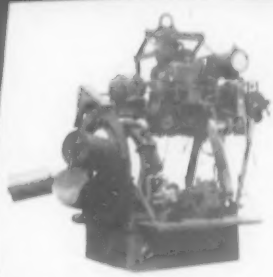

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Pipeline Patrol

miles of 4-in. Vermilion Parish, Louisiana, to be completed August 15, 1956.

El Paso Natural Gas Co.—Has under way 193 miles of 34-in. between San Juan basin and Topock, Ariz., and 38 miles of 20-in. between San Juan mainline and Phoenix, both to be completed February 1, 1957. Western Pipeline, Inc. has under way 146 miles of 34-in. between San Juan basin and Topock, to be completed February 1, 1957, and 112 miles of 20-in. between San Juan mainline and Phoenix, to be completed November 1, 1956. El Paso also has under way 34 miles of 24-in. from Ignacio, Colo., to the Blanco plant, to be completed October 1, 1956.

• **Empire Southern Gas Co.**—Groninger & King Construction Co. has a 10-mile, 8-in. line, and 5 miles of 4-in. gathering lines in Gray County, Texas, to be completed August 1, 1956; and a 4-mile, 8-in. loop south out of Pampa, Tex. A 9-mile, 8-in. loop northwest out of Big Spring, Tex., to be completed September 1, 1956, not let.

• **Hope Natural Gas Co.**—Plans 22 miles of 8-in. in Logan County, West Virginia, and 20 miles of 3 to 8-in. in various West Virginia counties, to be completed in 1956.

• **Houston Texas Gas & Oil Co.**—Applied to FPC for 960 miles between Baton Rouge and Miami: 507 miles of 30-in., 157 miles of 26-in., 61 miles of 20-in., 224 miles of 18-in., 12 miles of 12-in. Plans 500 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

• **Iron Ranges Natural Gas Co., St. Paul.**—Applied to FPC for a 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minnesota.

• **Kansas-Nebraska Natural Gas Co., Inc.**—Plans 11 miles of 12-in. from Colby to Oakley, Kans., to be completed August 1956. Plans 10 miles of 10-in. and 10 miles of 8-in. from Grand Island to Albion, Neb., to be completed November 1956.

Brodie Construction Co. has 32 miles of 4 to 12-in. gathering lines under way in Camrick field, Texas County, Oklahoma, to complete July 1956.

• **Lone Star Gas Co.**—Has two plans before FPC to enlarge system in Texas and Oklahoma: one is a 230-mile line from Cotton County, Oklahoma, to Fritch, Tex.; one is a 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line. Plans are attempt to keep Natural Gas Pipeline Co. of America from building line from Wise County, Texas, to Fritch.

Michigan Consolidated Gas Co.—Somerville Construction Co. has under way 67 miles of 10 and 12-in. between Sears and Travers City, Mich., Floyd Huduall, superintendent, office at Cadillac. Somerville, jointly with H. L. Gentry Construction, has under way 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich., Frank Morris, superintendent, office at Hart.

• **Michigan Wisconsin Pipe Line Co.**—Has FPC permit for 252 miles of 24, 18, 12, 6, and 4-in. loops in Wisconsin, to be completed November 1956.

Latex Construction Co., jointly with Houston Construction Co. and H. C. Price Co., has 90 miles of 16 and 20-in. between Milwaukee and Oshkosh, to start June 25 and complete October 1, 1956, John Phipps and U. J. Davenport, spread men.

• **Midwestern Gas Transmission Co.**—Will build a main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in. Plans 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin, pending FPC approval.

• **Natural Gas Pipeline Co. of America.**—

Pipeline Patrol

Has FPC approval for 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., which will be contested by Natural Gas Pipeline and Lone Star Gas Co. Filed for FPC permit for a 389-mile, 36-in. loop along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co. Also for 91 miles of 30-in. looping to be laid along parts of its main line. R. H. Fulton & Co. has under way 25 miles of 12-in. laterals and 18 miles of various size gathering lines in Gray and Roberts counties, Texas, to be completed July 14, 1956.

New York State Natural Gas Corp.—Williams-Austin Co. has 17 miles of 30-in. from Caton to Horseheads, Steuben County, New York, starting August 1, to complete November 1, 1956.

Niagara Mohawk Power Corp.—Let to various contractors, 275 miles of 2 to 12-in. distribution mains for growth of service areas in Central, Eastern, and Northern New York, to be completed December 31, 1956.

• **North Carolina Natural Gas Corp.**—This subsidiary of Colonial Natural Gas Corp. has permit from North Carolina Utilities Commission for 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across North Carolina.

• **Northern Natural Gas Co.**—Applied to FPC to add 348 miles of main line, 307 miles of branch lines in Wisconsin, Minnesota, South Dakota, and Iowa. Main lines include 169 miles in Duluth-Superior area, 164 miles in Aberdeen area of South Dakota. Proposes 73 miles of 20-in. from Savanna Creek to Pincher Creek fields in Alta., Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

• **Offshore Gathering Corp., Houston.**—Seeks FPC permit for 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in.; 70 miles of 26-in.; 234 miles of 30-in.

• **Pacific Gas & Electric Co.**—Will build 37 miles of 20-in., 37 miles of 18-in., 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento. Has under way a 6-mile gathering system at Beehive Bend. Also plans to loop the Topock-Milpitas line with 135 miles of 34-in., laying major part in 1956, and 67 miles in 1957. A joint-venture firm, Midwestern-Johnson-Dixon, has 85 miles of this to complete in 1956.

• **Pacific Northwest Pipeline Corp.**—Has FPC permit for 37 miles of 6-in. from Dove Creek, Colo., to Nucla, and 13 miles of 4-in. from Nucla to Uravan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America. Work under way on other trunk and sales laterals:

A. P. V. Co., Inc., 81 miles 26-in. between Plymouth and Goldendale, Wash., nearing completion.

Engineers Limited, Inc., 55 miles 26-in. between Goldendale and Stevenson, Wash., to complete July 1956, Louis Robertson, superintendent, office at White Salmon.

River Construction Corp., 64 miles 26-in. between Toledo and Tacoma, to be completed August 1, 1956, Vernon Gayhart, spread man, office at Vancouver, Wash.; also 16 miles of 18-in. out of Portland, Ore., completed.

R. H. Fulton & Co., 156 miles 20 and 16-in. lateral from main line to Spokane; also 129 miles of laterals into Idaho, to complete fall 1956.

• **Permian Basin Pipeline Co.**—Has FPC permit for 19 miles of 16-in. in Andrews County, Texas.

• **Piedmont Gas Co., Hickory, N. C.**—(Parent is Carolina Natural Gas Corp.) Seeks FPC permit for 78 miles of 2 to 8-in. extension off Transcontinental in North Carolina, to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.

Portland Gas & Coke Co.—United Engineers & Constructors, Inc., of Philadelphia, has engineering contract for 80 miles of various size lines up to 16-in.

Signal Oil & Gas Co.—C. P. Bartley & Son has 70 miles of 2 to 16-in. gathering system near Tioga, N. D., to be completed September 1, 1956. C. P. Bartley, Jr., and Lawrence Barto, spread men, office at Tioga.

• **Southern California Gas Co. and Southern Counties Gas Co. of California.**—Have permit for 239 miles of 30-in. from Topock, Ariz., to Newhall, Calif., to start November 1956, to complete 1957.

Also building 49 miles of 30-in. from Newhall to Alhambra, Calif. Work is under way by: Alex Robertson Co., 13 miles; Macco Corp., 16 miles; Joe E. Young Contractors, Inc., 19 miles. To be completed December 1, 1956.

• **Southern Natural Gas Co.**—Has temporary FPC authority for 39 miles of loops near Atlanta, Ga.

• **Tennessee Gas Transmission Co.**—192 miles of 24-in., 34 miles of 20-in., 15 miles of 18-in., 110 miles of 4, 6, 8, 10, and 12-in. laterals to extend gathering system from west of Crowley, La., to tie in to Tennessee Gas gathering line, eastward across southeast Louisiana, to mouth of Mississippi River, with laterals extending into Gulf of Mexico, to be completed mid-1956. Project completed except for:

Williams Brothers Co. has 55-mile, 24-in.

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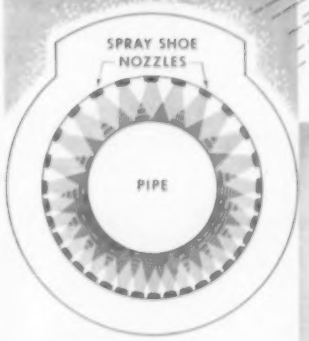

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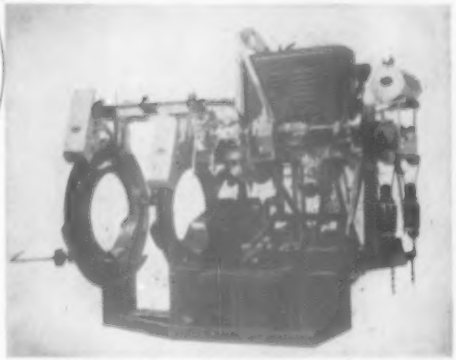

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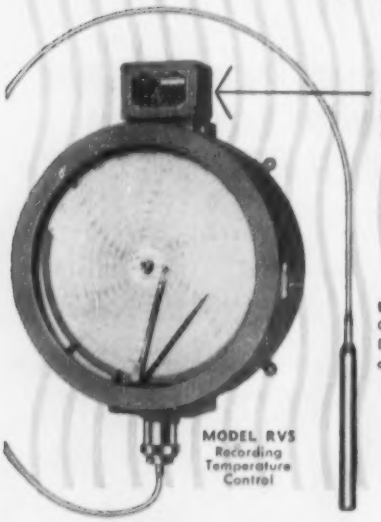
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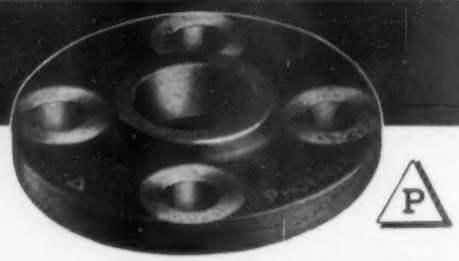

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marine job from Cocodrie, La., east of Bay Chalon area, spread man, W. A. Briley.

2—Bechtel Corp. has 74 miles of 30-in. looping from Glasgow to Danville, Ky., to complete by October 1, 1956, Joe L. Work, spread man, office at Greensburg, Ky.

3—142 miles of 26-in. looping in Ohio, to be completed fall 1956, under contract to: H. C. Price, 81 miles from near New Boston to near McConnelsville, G. A. Reutzel, spread man, office at Chauncey; Oklahoma Construction Co., 61 miles from near Newcomerstown to near Lisbon.

4—Applied for FPC permit for 63 miles of 30-in. looping from Scottsville, Ky., to Cave City, and from southwest of Danville to northeast of Danville.

5—Seeks FPC permit for 99 miles of 26-in. looping from Greenup, Ky., to north of Ohio River, from McConnellsville to Newcomerstown, and from Lisbon, Ohio, to near Mercer, Pa.

6—Seeks FPC permit for 100 miles of 4, 6, 8, 10, and 12-in. gathering line in Texas-Louisiana Gulf Coast area.

• **Texas Eastern Transmission Co.**—Applied to FPC, December 1955, for 422-miles of 30-in. from McAllen to Beaumont, Tex., to move imported Mexican gas. Applied for 530 miles of 30-in. looping from Kosciusko, Miss., to Uniontown, Pa. Will lay 45 miles of 24-in. from Provident City, Tex., to connect in Matagorda County, Texas, to tie the Wilcox Trend Gathering System with the extension from Mexico.

Altgelt Construction Co., Inc., has under way 30 miles of 8-in. and 3 miles of 6-in. near Houston, to complete July 1956.

Texas Gas Transmission Corp.—Houston Contracting Co. has 53 miles of 30-in. looping from Chicot, Ark., to Clarksdale, Miss., to complete August 31, 1956; 108 miles of 20-in. and 3 miles of 12-in. from Eunice to Lake Palourdes, La., to complete December 20, 1956; 11 miles of 16-in. loops near Roanoke, La., to complete October 20, 1956; 2 to 16-in. Atchafala River crossing near Morgan City, La., to complete September 1, 1956; 22 miles of reconditioning of 18-in. near Wilmot, Ark., and Clarksdale, Miss.

Union Construction Co. has under way 21 miles of 12-in. from Petersburg to Bicknell, Ind., to complete August 15, 1956.

Pentzien, Inc., has Mississippi River crossing near Greenville, Miss., to complete December 15, 1956.

• **Trans Carolina Pipe Line Corp., Commercial Building, Raleigh, N. Car.—Seeks FPC permit for 300-mile system across North and South Carolina, plus 500 miles of laterals.**

• **Transcontinental Gas Pipe Line Corp.—Has applied to FPC to lay 160 miles of 36-in., 67 miles of 30-in., and 24 miles of 24-in. loops from Louisiana to Pennsylvania, to be completed December 1, 1956; 25 miles of 36-in. loops from Louisiana to South Carolina, to lay in 1957.**

Winchester and Vienna, Ill., Cities of— M. L. Hulcher Co., Inc., has 21 miles of 8-in. for Winchester, to complete September 30, 1956, Rolfe, superintendent; has 10 miles of 4-in. for Vienna, to complete August 15, 1956, Wilkerson, superintendent.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.—Firm is building a 140-mile, 20-in. line from Safaniya field to Ras Tanura.

• **Canadian Gulf Oil Co.**—Seeks approval for 35 miles of 8-in. to connect Drumhell field, Alberta, with existing Gulf lines running to Edmonton.

Cremona Pipe Lines, Ltd. — Dutton-Williams Brothers, Ltd., has 60-mile, 8-in. line from Sundre-Westward Ho region to Cal-

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gary, to be completed August 1956. Company is subsidiary of Home Oil Co.

Creole Petroleum Corp.—Williams Brothers Sudamericano, Ltd., has under way 15 miles of 34-in. from Pueblo Viejo to Lagunillas, Venezuela, to be completed August 1, 1956.

Gulf Italia Co.—Will complete late summer 1956, 35 miles from its Ragusa field in southwestern Sicily to RASIOM's refinery at Augusta.

Interprovincial Pipe Line Co.—Majestic Contractors, Ltd., has under way 67 miles of 24-in. between Carroll and Somerset, Man.; 2 miles of 26-in. between U. S. border and Gretna pumping station, to complete August 31, 1956.

Has applied to Board of Transport Commissioners for 151 miles of 20-in., an extension of its line from Sarnia to Port Credit, Ont. If approved, work will start spring 1957, end that fall.

• **Mene Grande Oil Co.**—Plans 11 miles of 6-in. from Elias to Fria, and 10 miles of 10-in. from Limon to Leona-Dacion Lateral, Venezuela, to complete first quarter 1957; 24 miles of 12, 14, 16-in. from Oficina Tank Farm to Oveja, to complete in 1956.

Peace River Oil Pipe Lines, Ltd.—Fulton Banister, Ltd., has contract to coat and bury 45 miles of 12 and 16-in. from Valleyview to Edson, Alta. (Line was welded above ground last year). Jerry Nash is superintendent, office at Valleyview.

Pembina Pipe Line, Ltd.—Sparling Davis Co., Ltd., has 100 miles of 3 to 10-in. gathering system in Pembina field.

Mannix, Ltd., has 200 miles of 3 to 12-in. gathering lines in Pembina field, F. Whitlow, superintendent, office in Pembina field.

PEMEX.—Constructora El Aguila, S. A., has 50 miles of 20-in. from Angostura to Veracruz, Antonio Sanz Polo, spread man, office at Veracruz.

• **Rangeland Pipeline, Ltd.**—Will build 17 miles of 6-in. and 16 miles of 4-in. from west end of Joffre field to connect West Gilby; 10 miles of 12-in. from Gilby Junction to Rimbey field, Alberta. Work to be completed fall 1956.

• **Royal Pipe Lines Co., Ltd.**—Proposes a 290-mile Saskatchewan line from Cantuar to Dollard, east to area served by Westspur, then north to Interprovincial's Glenavon station.

• **Sinclair Oil Corp. and Socony Mobil Oil Co.**—Will build 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.

• **South Saskatchewn Pipe Line Co.**—Plans 58 miles of 12-in. from Cantaur field to Dollard field in Saskatchewan, to start in July, end September 1956.

• **Texaco Exploration Co.**—Plans 22 miles of 12-in. and 3 miles of 8-in. between Westerose and Rimbey pools, Alberta, Can.

Union of Soviet Socialist Republic.—Has under way a 2,300-mile Trans-Siberian crude and products system from Ufa and the Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.

Westspur Pipe Line Co.—Majestic Contractors, Ltd., has 109 miles of 12-in. from Midale, Sask., to Interprovincial Pipe Line Co.'s pump station at Cromer, Man., and 50 miles of various size gathering lines in Midale-Frobisher area, to complete fall 1956.

Yacimientos Petroliferos Fiscales (Argentina).—Has started 700 miles of 12-in. from Campo Duran to San Lorenzo. TECHINT, (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)—Williams Brothers Co. has 160 miles of 10-in. and 43 miles of 8-in. from Sicasica to Arica on the Chilean coast, to be completed December 1957.

Foreign Products Pipelines

• **Canadian Hydrocarbons, Ltd., Winnipeg**—Proposes 800-mile LPG line from Edmonton, Alta., to Winnipeg.

• **Estrada de Ferro Santos a Jundial Departamento Oleoducto.**—Plans 6 miles of 14-in. from the Capuava Refinery to Utinga Terminal, to be completed December 1956.

• **Imperial Oil, Ltd.**—Will lay 38 miles of 12-in. loop along present line from Waterdown, Ont., to Toronto.

• **Iraq Petroleum Co., Ltd.**—Plans 75 miles of 24-in., 180,000-bbl. daily capacity, from Homs, Syria, to Tripoli, Lebanon.

National Iranian Oil Co.—Contracts let on 573 miles of 10-in., 40,000-bbl. daily capacity, from Ahwaz to Teheran, Iran; Constain-John Brown, Ltd., London, and Williams Brothers Co., started February 1956, laying southern 337 miles; Enterpose of Paris, has northern 236 miles.

• **North Atlantic Treaty Organization (NATO).**—Laying 2,000 miles of lines to airfields in parts of Europe. Associated Pipeline Contractors, Inc., has 450 miles from Iskenderun, Turkey, to Batman. TECHINT (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956, on 300 miles of 12-in. between Marseille and Langres, France.

PEMEX.—Constructora El Aguila, S. A., has 155 miles of 12-in. from Tampico to Cd. Victoria, Geronimo Aviuchastegui, spread man, office at Tampico.

The United States Defense Department.—Sponsoring 485 miles of 8, 10, 12-in. from Cadiz to Zaragoza, Spain. Contracts let to Merritt Chapman & Scott; Benson & Montin of Oklahoma City; Agroman Construction Co. of Spain. Prime contractor is Brown-Raymond-Walsh.

Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)—Williams Brothers Co. has 190 miles of 4-in. from Camiri to Santa Cruz, to be completed December 1956.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co.**—Plans 547 miles of gathering system for the Trans-Canada line. About 40 miles of 34-in. will be laid in 1956 to connect Bindloss field. Remainder to be laid in 1957 and 1958. Fields to be connected are Pincher Junction, Provost, Sibbald, Oyen, Sunnynook, Steveville, Cessford, Countess, Dutchess, Princess, Homeglenn, Rimbey, Nevis.

Andes Pipeline Corp.—This subsidiary of Glenn McCarthy, Inc., will build and operate 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper mining area.

Attock Oil Co.—Plans 60 miles from Dhulian field to Rawalpindi in West Pakistan.

B. C. Electric Co., Ltd.—Mannix, Ltd., has 45 miles of 18 and 20-in. between Huntingdon, B. C., and Vancouver, G. Lyons, superintendent, office at Langley.

Cia. Shell de Venezuela.—Plans 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces. To be completed in 1957.

• **Empresa Nacional del Petroleo.**—80 miles, 10-in., planned, Concon to Santiago, Chile.

• **Estrada de Ferro Santos a Jundial Departamento Oleoducto.**—Plans 16 miles of 6-in. from Cubatao refinery to Elcloro plant, to be completed December 1956.

• **Gas Industrial de Monterrey.**—Plans 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Imperial Oil, Ltd.—Has let 65 miles of 4 to 16-in. gathering system in Redwater area of Alta., to Majestic Contractors, Ltd.

• **Magna Pipeline Co.**—Plans to complete fall 1956, an underwater line from Anacortes or Bellingham, Wash., to Victoria.

New British Dominion Oil Co.—Started June 22 on a 46-mile line from Etzikom gas

Pipeline Patrol

field to Medicine Hat, Alberta, to be completed mid-August 1956.

North Canadian Oils, Ltd.—Dutton-Williams Brothers, Ltd., has 136 miles of 10-in. from Lake Wabumun to Hinton, Alta., to be completed August 1956, L. A. Stewart, spread man, office at Onoway, Alta. Crossings of the McCleod River, Pembina River, and Wolf Creek are being made early.

PEMEX—Plans starting July 1956, on 22-in. line between Reynosa and Monterrey.

Saskatchewan Power Corp.—Fulton Banister, Ltd., has 229 miles in Saskatchewan, Jerry Nash, general superintendent: 115 miles of 12-in. from Success to Moose Jaw, starting July 15, to complete September 1, 1956, office at Swift Current; 53 miles of 6-in. from Biggar to North Battleford and 30 miles of 8-in. from Dana to Humboldt, completed; 17 miles of 10-in., 8 miles of 6-in., and 6 miles of 4-in. Hoosier extension and gathering lines from Brock field to Eston Transmission lines, to complete October 1, 1956, office at Kindersley.

South Alberta Pipe Line, Ltd.—Filed permit for 150 miles of 8-in. from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta.

Dutton-Williams Brothers, Ltd., has 45 miles of 10-in. between Etzikom and Medicine Hat, to complete July 1956, P. D. Campbell, superintendent, office at Medicine Hat.

Sui Gas Transmission Co.—Pakistan Constructors, a joint company of Morrison-Knudsen of Boise, Ida., and William Press, Ltd., of London, have 188 miles of 16-in. from Sui gas field to Moultan, Pakistan. Work begins mid-1956. Line to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**—Proposes a 321-km., 26-in. line from Anaco to La Mariposa near Caracas.

• **Trans-Canada Pipe Lines, Ltd.**—Work begins July 1, 1956, on 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. Contracts let on first four sections to: Majestic Contractors, Ltd.; Canadian Bechtel, Ltd.; Mannix Ltd.; Dutton-Williams Brothers, Ltd. Three sections still to be let. Completion of this stretch planned for December 1, 1956. This is the first stretch of a 2,250-mile line from Alberta to Toronto and Montreal. Deadline for exporting gas from Alberta is December 31, 1957. Tennessee Gas Transmission Co. has proposed a line to take the gas at Emerson, Man. (See Midwestern Gas Transmission Co.).

Union of Soviet Socialist Republic.—Has completed 200 miles (between Stavropol and Rostov) of a 900-mile, 26-in. line from Stavropol in the Northern Caucasus to Moscow. The line, larger than Russia's other two major gas lines which are only 16 and 18-in., will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Westcoast Transmission Co., Ltd.—Has let 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash. Dutton-Williams Brothers, Ltd., has 120 miles from Taylor, B. C., to Azouzetta Lake, to be completed September 1957, O. Graves, spread man, office at Dawson Creek, B. C.

Mannix, Ltd., has 110 miles between Huntingdon and Merritt, Fred Byers, superintendent, office at Chilliwack.

Canadian Bechtel, Ltd., construction division, has 210 miles from Alexandria to Pine Pass, B. C. to complete September 15, 1957, H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.

R. A. Conyes Construction Co. has remaining 210 miles, to complete September 1957.

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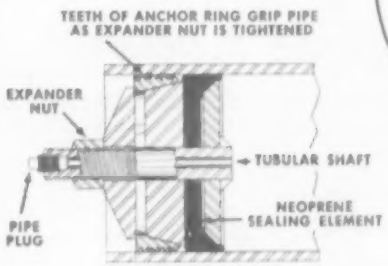

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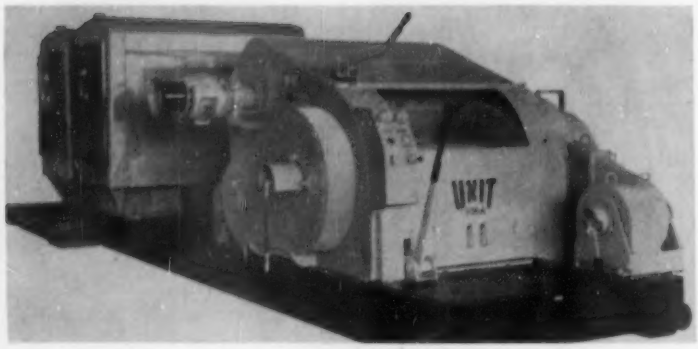


Draw Works Rated 300 to 600 Hp.

The new U-36-A torque-converter draw works with a rated maximum input horsepower of 600, is designed for drilling depths requiring horsepower range from 300 to 600 but can be economically used in areas where drilling requires less horsepower. This draw works has a large maximum wireline life. The barrel is 46 in. long and has an 18-in. diameter.

For field moves this unit is a compact, one-package load. It breaks into two packages for highway moves. One, two, or three engines and compound, mounted on a common skid, comprise one load. The draw works, complete with hydromatic brake, makes up a second load.

Other important features of this new draw works are fully enclosed, water-circulating brake rims of forged alloy steel, heat treated for maximum service life (44-in. diameter and 10-in.-wide flange). Main drum brakes are fully equalized, self-energized, and single-point adjusted.

This draw works has an air clutch for the catshaft drive to eliminate necessity of an inertia brake. On a double drum unit this catshaft air clutch also allows use of positive clutch on sandreel and eliminates introduction of air through cathead. Control panel consists of only four air valves.

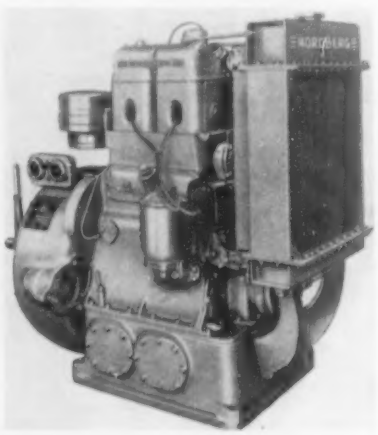
The U-36-A is available in single and double drum models and can be trailer mounted. **For more information write or call: Unit Rig & Equipment Co., P. O. Box 1889, Tulsa 1, Okla.**

●

Gas Engine for Pumping Rated 12 to 24 Hp.

Addition of a two-cylinder gas engine to the Power Chief series of small diesel and gas prime movers extends the horsepower range for oil-field-pumping service.

This new two-cylinder model has an A.P.I. rating of 12-24 hp. at 800-1,800 r.p.m. It is equipped with a combination gas-gasoline carburetor and a gas-



pressure regulator. Safety shut-down controls for low oil pressure/high water temperature are also standard equipment. Additional safety features are an

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enclosed clutch, enclosed flywheel, and an enclosed fan.

With a bore of 4½ in. and a 5¼-in. stroke, this four-cycle engine has a piston displacement of 167 cu. in. The compression ratio is 6 to 1. The radiator is large enough to assure trouble-free operations at ambient temperatures up to 125° F. **For more information write or call: Nordberg Manufacturing Co., Milwaukee 1, Wis.**

●

Tool Pusher Speed Boat Features Heavy Steel Skin

A new tool pusher speed boat is designed for use by the oil industry in offshore operations. This boat is used for fast transportation between shore and drilling rigs delivering supplies and personnel. It is also used as an express commuter for company officers making inspection.

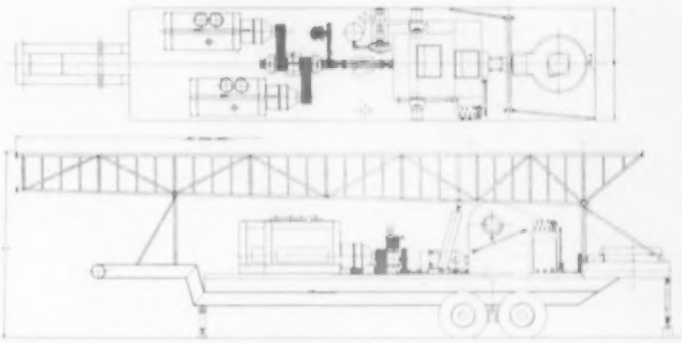
The boat is built with the skin-stress type of hull construction. The hull is formed from steel under pressure which gives it strength and the ability to withstand rough usage. The boat

is no heavier with this heavy steel skin than conventionally built boats. The skin is resistant to puncture and can take the pounding received at drilling barges in rough water.

The boat is powered with a 145-hp., V-drive Universal marine engine. The engine is in the rear of the boat with a fireproof bulkhead between the engine compartment and the passenger cockpit. This arrangement provides greater safety and eliminates engine fumes in the boat cabin. **For more information write or call: Jack Casey, Casey Craft, Box 175, Mermentau, La.**

●

OIL AND GAS JOURNAL **Showcase** .....OF NEW EQUIPMENT



Slim-Hole Rig Rated to 5,100 Ft.

The Model 510 portable slim-hole rotary drilling rig is trailer-mounted and can be moved to nearly any drilling site, rigged up and be operating in a few hours time. The Model 510 can drill to depths of 5,100 ft. with 3½-in. drill pipe and can reach more than 10,000 ft. with 2½-in. pipe. Maximum hook load is 100,000 lb. Minimum size of the power unit is 140 hp. at 1,800 r.p.m.

Features of the rig are an oil-bath rotary table with an 18-in. opening and A.P.I. taper, air-operated clutches, a hydromatic brake for the hoisting drum, and an 85-ft. mast with 80 ft. of clearance between the top of the rotary table and the bottom of the crown block. Table-to-ground distance is 5 ft. The mast will hold Range 2 doubles.

Mounted on a single trailer, the rig has been built to observe highway clearances for over-the-road movement. Width is 8 ft. Over-all trailer length is 37 ft., and the length of the lower half of the mast is 45 ft. Load height is 13 ft. 6 in.

For fast rigup and teardown, the sectional mast is raised by two hydraulic cylinders. Substructure jacks level the unit quickly.

Air clutches permit close sensitive control of all drilling operations. Power take-off clutches; hydromatic jaw clutch; master compound-drive clutch; draw-works, sand-line, and cathead clutches are all air actuated. Torque-converter transmission provides high torque under stall conditions.

Controls are grouped for easy operation. **For more information write or call: Joy Manufacturing Co., 333 Oliver Building, Pittsburgh 22, Pa.**

●

Selector Valve Does Work Of Crude-Manifold System

A new rotary multiport selector valve is designed to eliminate complicated manifold systems in producing fields. It does this by bringing the crude from as many as seven pipelines to a central source for sampling, metering, and testing. One output line leads to consumption or storage facilities, and one intake may be tested at any given time without flow interruption or contamination from the remaining ports. The rotor assembly is rotated to perfect alignment with any of the seven intakes. It turns on a machined Teflon bearing.

The valve can be equipped with a standard set of electrical controls for its application to automation in oil production. The valve has been field tested under severe conditions. **For more information write or call: William B. Pollock, Win-Well, Inc., 8460 West Third Street, Los Angeles 48, Calif.**

●

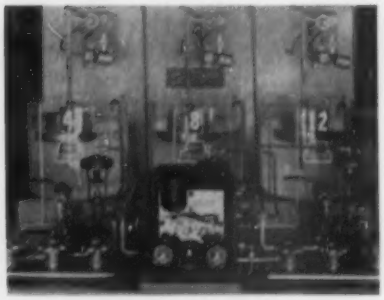
Tank Switcher Features Single Selector Control

A new automatic tank-switching unit features a single selector-controller used for a multiple-tank-battery operation.

It is composed of (1) Masoneilan automatic selector-controller, designed to carry 2 to 12 tanks in one battery, (2) liquid-level controllers, (3) interlocks which hold the fill valve closed when oil is drained to pipeline or recirculated through heater-treater, and (4) pres-

Oil and Gas Journal Showcase

.....OF NEW EQUIPMENT



sure gages showing whether tank is being filled, drained, or recirculated.

Entirely pneumatic, with selector-controller and gages panel-mounted, the unit may be operated by compressed air or gas. The Masoneilan selector-controller has a nonbleed pilot and provides continuous scanning of all tanks in the battery. **For more information write or call: Maintenance Engineering Corp., 3711 Clinton Drive, Houston, Tex.**

●

Slugs Used to Clean Condenser of Slime, Scale

The Super-Jet condenser cleaning tool provides fast cleaning of condenser tubes. It utilizes a handy gun-and-slug method to remove slime and scale at a time savings over ordinary mechanical methods. One man can quickly load an entire bank with cleaning slugs and shoot them through in rapid succession. The result is reduced labor and shut-down time.

The gun is a lightweight, rugged-duty tool, weighing only 2¾ lb. It can be operated by either air or water pressure. Effective pressures range from 50 to 200 psi.

Three types of cleaning slugs in sizes to fit all standard tubes can be furnished. Spool-type slugs, for normal slime removal, are designed with a cup at the forward end which expands

to wipe the inside of the tube clean. Bullet-shaped slugs are for removing heavier or thick slime deposits. Scraper-type slugs cut away scale or mineral deposits as they are driven through the tube. The latter two types have jet-action holes in the side wall to admit water or air for flushing away deposits as they are removed. **For more information write or call: Crane Packing Co., 6400 Oakton Street, Morton Grove, Ill.**

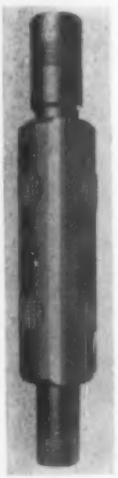
Coupling Used as Hand Valve or Quick-Coupler

A new failproof, leakproof Dubl-Safe valve coupling employs a new principle and can be used both as a hand valve and quick-coupler. The device consists of a primary valve within a secondary valve. The primary valve is first to open and last to close, which serves as a safety device for the main valve.

All sealing elements and working parts are enclosed and fully protected from outside damage. A J-slot locking design allows the coupling to be rocked to break frozen joints. The valve can be adapted so that one member is stationary and the other made up on a line, or the device can be used as a hose-to-hose coupling. **For more information write or call Harbison-Fischer Manufacturing Co., P. O. Box 127, Fort Worth, Tex.**

●

Hydraulic Holddown Used With Any Packer



The new type HR-6 hydraulic holddown is designed for any production-type packer. It provides increased slip area with six slips for greater gripping and features three large bypass grooves to speed running into the hole.

Tubing pressure is used to hold packer down. The higher the pressure, the tighter the grip. Slip-holding area and piston area are selected to assure positive gripping regardless of tubing pressure and casing size. The proved slip-type teeth provide positive grip with minimum damage to casing, with slips carburized for long wear.

The HR-6 has polished piston and cylinder bores, is Parkerized throughout to prevent corrosion, and the nickel-plated springs keep slips in retracted position to prevent wear while running in the hole. **For more information write or call: Texas Iron Works, 1423 Maury Street, Houston, Tex.**

Oil and Gas Journal Showcase Coupon

USE THIS FORM TO OBTAIN INFORMATION ON ITEM DESCRIBED HERE

MANUFACTURER _____

ADDRESS _____

CITY _____ **STATE** _____

Please send me complete information on the following item

_____

_____

Described in the July 9, 1956, issue of The Oil and Gas Journal

NAME _____ **TITLE** _____

COMPANY _____

ADDRESS _____

CITY _____ **STATE** _____

DATE _____

Now! Aircraft power—remote controlled for fracturing, acidizing

The 1500 h.p. Allison aircraft engine, after posting a remarkable record as a power plant for fighter planes, has been adapted by Dowell to bring you increased fracturing and acidizing effectiveness.

It's the most powerful engine in fracturing—12 cylinders, liquid cooled. And Dowell has mounted it on one truck together with the specially built DR power-frame pump for compactness, mobility and efficiency. Here's power when you want it.

In addition, you get the advantages of the revolutionary Dowell-developed Remote Control Panel—the first of its kind. This panel gives the operator complete control over engine starting, operation and shutdown from any distance up to 125 feet.

Automatic controls prevent maximum pressures and volumes from being exceeded. The entire unit shuts down when pre-set limits have been reached. Never before has it been possible to offer such safety to men and equipment.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. G-11.

services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

MOBILBEAD
(FORMERLY SOVABEAD)

Soaks Up Moisture Twice As Fast

Nearly doubles your dehydrator efficiency!

- Maintains efficiency at temperatures as high as 120°F.
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- Eliminates caking, reduces channeling, dusting and pressure drops.

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SOCONY MOBIL
Process Products

SOCONY MOBIL OIL COMPANY, INC.
26 Broadway, New York 4, N. Y., and Affiliates:
MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

OIL AND GAS JOURNAL Showcase

- BULLETINS
- CATALOGS
- BROCHURES

Rotary Drilling Outfit. The 16-page, four-color Booklet 100-500-54 describes the Type GH 900 drilling rig. This German-built rig is designed to drill to 10,000 ft. with 4½-in. drill pipe. Details of the performance, setup, and transport are given. Photographs show mast equipment, engines, chain-drive compound, and the draw works. A full-page line drawing illustrates the 136-ft. mast suitable for a crown load of 300 tons. Engineering drawings and specifications are presented. **For more information write or call: Alfred Wirth & Co., Erkelenz (RHLD), Germany.**

●

Design Pressures for Steel Pipe for Gas Transmission and Distribution Systems is a handy, 83-page reference work for gas-pipeline engineers. Bulletin 55-2, leatherette-bound and tab-indexed, presents allowable working pressures conforming to recently revised Section 8 of the A.S.A. code for pressure piping B31.1.8-1955. Design pressures for various grades of pipe in sizes 6 through 42 in. are numerically tabulated and then plotted in chart form. This is done for each of the four basic types of construction covered in this standard. **For more information write or call: Ladish Co., Cudahy, Wis.**

●

Type "W" (Independent) Tubing Head, a four-page, three-color folder, uses cutaway drawings to illustrate the Type "W" and Type "W-I" tubing heads. Bulletin 460 also illustrates interchangeable tubing hangers, bonnets, and tubing supports. This equipment is designed for pressures of 1,000, 2,000, and 3,000 psi. The tubing heads have 2, 2½, and 3-in. threaded outlets and eight sizes of bottom threads between 4½ and 8⅝ in. A page on applications pictures typical assemblies. **For more information write or call: The National Supply Co., 2 Gateway Center, Pittsburgh 22, Pa.**

●

Answers to Questions About Diesels. This 24-page, two-color booklet is planned to acquaint the reader with the basic principles of diesel operation. It is written in a question-and-answer form in simple, nontechnical terms. Multicolor graphs and charts compare the efficiency, fuel-energy distribution, and engine weights of diesels and other types of engines. Cutaway drawings illustrate fuel systems, ignition systems, and supercharging. Information on operation and service is included. **For more information write or call: Cummins Engine Co., Inc., Columbus, Ind.**

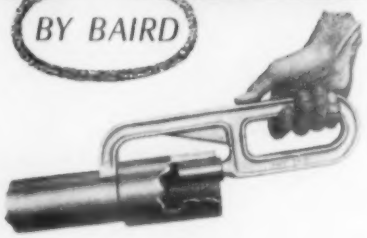
●

Opportunities Unlimited — Using Trufin. This new booklet covers a number of the applications where Trufin (the integrally finned tube) is used and can be used, such as field processing, refining, petrochemical, electrical, water heater, refrigeration, and compressor stations. **For more information write or call: Wolverine Tube, Division of Calumet & Hecla, Inc., Guardian Towers, Guardian Building, Detroit 26, Mich.**

●

1,000-Lb. W.O.G. Bronze Gate Valves for Cementing-Acidizing. A new three-color, illustrated circular describes a bronze globe valve especially designed for cementing and acidizing service.

TUBING GRIPPER
BY BAIRD



To Handle Tubing safer . . . easier

- Applied to the collar and you can push or pull.
- Made of special aluminum alloy — it weighs less than two lbs.
- The rubber covered prong protects internal threads.

Always Available Through Your Supply Store

"Wherever there's oil, you'll find Baird products on the job."

Baird MANUFACTURING COMPANY
P. O. Box 380 Tulsa, Oklahoma

Designated as Fig. 1803, the valve is used extensively by oil-field service companies in severe applications where a rugged 1,000-lb. w.o.g. bronze gate is required. Features of the Fig. 1803 include a flexible single-wedge disk and a stem guard to prevent bending or breaking of the stem under rough usage. **For more information write or call: Lunkenheimer Co., Box 360, Cincinnati 14, Ohio.**

●

Manual and Automatic Valves for Tough Jobs, a two-color, 20-page catalog is useful to pressure-system design engineers and to users of automatic control and manual valve equipment. Using engineering drawings and charts, this catalog presents the operating principle and mechanical operation of the Paul valve. It also gives valve performance and engineering data. Material specifications, valve sizes, and pressure and temperature ranges are given in table form. Described are automatic-control, manual-control, blow-off, and industrial-hose valves. **For more information write or call: P-K Industries, 27 Porete Avenue, North Arlington, N. J.**

●

No. 120 Series Algaecide. A new simple, low-cost way to stop algae problems in cooling systems through use of No. 120 Series algaecide is described in a two-color leaflet. The new algaecide is a complex rosin-base liquid, weighing approximately 1 lb. per pint. It is simple to apply and safe to use. Bulletin 28X8434 contains a table illustrating the effectiveness of the liquid on six different species of algae. No. 120 Series algaecide is currently being used in numerous industries to successfully control algae and other microscopic organisms which complicate the over-all water-treatment program in cooling systems. **For more information write or call: Allis-Chalmers Manufacturing Co., 1509 South Seventieth Street, Milwaukee, Wis.**

●

Deaeration — Why? How? Publication 4650, a two-color folder, deals with the problem of conditioning water to prevent corrosion. Iron and steel corrosion and its control, including deaeration, heating, and other phases of water conditioning are covered. The principles of mechanical deaeration and types of equipment are included in this four-page folder. Temperature-solubility tables are used to illustrate the problems involved. **For more information write or call: Cochrane Corp., Seventeenth Street below Allegheny Avenue, Philadelphia 32, Pa.**

This announcement is neither an offer to sell nor a solicitation of an offer to buy these securities. The offer is made only by the Prospectus.

350,000 Shares

Halliburton Oil Well Cementing Company

Common Stock

(Par Value $5 per Share)

Price $78.75 per Share

Copies of the Prospectus may be obtained in any State only from such of the several underwriters, including the undersigned, as may lawfully offer the securities in such State.

LEHMAN BROTHERS BLYTH & CO., INC.

June 20, 1956

The low cost method of corrosion control in gas lift and flowing water-drive wells!

BAKED-ON PLASTIC COATINGS FOR CORROSION-RESISTANT TUBULAR GOODS

PLASTICAP Coatings let you measure corrosion control costs by the simple formula *Original cost of Coating divided by Anticipated Total Recovery.* With PLASTICAP Coatings, that's it! The first cost is the last cost. There's no service, no maintenance, no fixed cost per barrel of fluid produced. You get complete protection for the life of the well, and as total volume produced increases, *costs per barrel decrease.*

Ask for a quotation on PLASTICAP Coatings for your tubing, mandrels and fittings. Determine your *cost per barrel* by applying the formula to a theoretical well. The answer will show why so many majors and independents have standardized on PLASTICAP Coatings for corrosion control.

QUICK DELIVERY FROM TWO MODERN PLANTS

PLASTIC APPLICATORS, INC.

HOUSTON, TEXAS HARVEY, LOUISIANA

PLASTIC APPLICATORS, INC., P. O. BOX 7631, HOUSTON, TEXAS

Please send information on PLASTICAP BAKED-ON COATINGS.

NAME _____ COMPANY _____

ADDRESS _____ CITY _____ STATE _____

EQUIPMENT MEN . . . in the News

Mission Appoints City Sales Representatives

John H. Brown and John Holland Bannister have been appointed city sales representatives at Tulsa and Midland, Tex., for Mission Manufacturing Co., according to Ted Fullinwider, sales manager.

Brown formerly represented Mission in the Kansas territory having headquarters at Great Bend, Kans. He has had 15 years' experience in the equipment-supply business.

Bannister has been in sales work with Mission since 1947. He was formerly located at Hobbs, N. M., as a field sales representative.

Daniel Appointed Sales Engineer by Core Labs

The recent promotion of Larry Daniel to the position of sales engineer for Core Laboratories, Inc.'s, operations in the Lubbock, Pampa, and Amarillo areas of Texas is announced.

Daniel has been with Core Laboratories since 1950. Immediately prior to his current assignment, he was engineer in charge of the company's Lubbock, Tex., laboratory operations.

This structure is the new home of Jones & Laughlin Supply Division's oil-field-supply store at Wichita Falls, Tex.

J&L Wichita Falls Store Moves to New Quarters

Rainey Elliott, president of Jones & Laughlin Supply Division headquartered in Tulsa, has announced the recent move of the firm's Wichita Falls oil-field-supply store. The new building houses an office at the front, a completely equipped Axelson pump-repair shop, and a warehouse at the rear.

Personnel assisting R. P. Conley, local store manager, in the operation of the store are: Verda R. DuBose, Fred R. Luther, James E. Redd, and Philip E. Slater, Jr.

The Wichita Falls store is under the supervision of W. R. Layne, district sales manager of the firm's North Texas district.

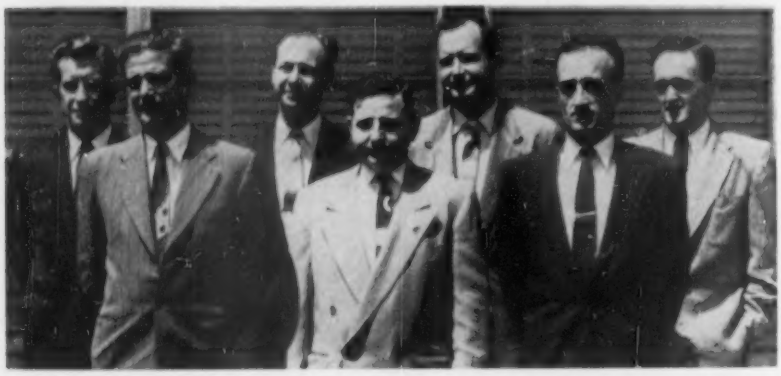
BJ Tools Appoints Magoffin and Roberts

J. P. MAGOFFIN

The appointment of J. P. Magoffin as product sales manager for BJ Red Top centralizers and scratchers and naming of W. F. Roberts as city salesman in Oklahoma City have been announced by V. C. Horner, vice president and manager of sales for Byron Jackson Tools, Inc., a subsidiary of Borg-Warner Corp.

Magoffin has been with Byron Jackson 13 years and, in addition to his new duties, will continue as Rocky Mountain regional manager. Roberts has been in BJ's main office in Los Angeles, serving as administrative assistant to Garth Nicolson, vice president and general manager of oil-tool operations.

David Jackson has been chosen to serve as administrative assistant in Roberts' absence.



Recent students at Halliburton's operators' school at Houston: front row, Roger DeVerteuil, Trinidad, British West Indies; I. R. Lambert, Pratt, Kans.; W. J. Smith, Abilene, Tex. Back row, W. E. Robertson, Liberty, Tex.; W. R. Peavy, Duncan, Okla.; W. B. Evans, Gainesville, Tex.; and G. F. Gunning, Edmonton, Alta.

EWS Operators Study at Halliburton's Research Lab

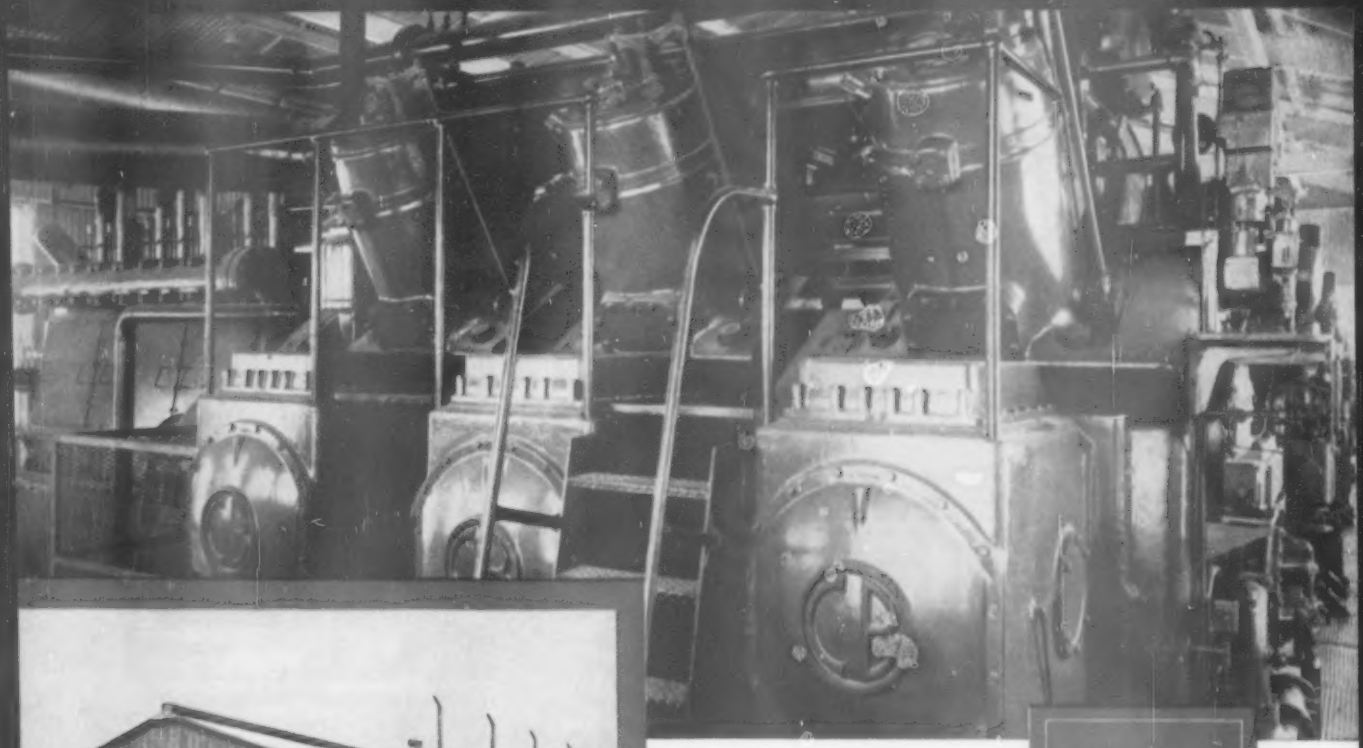
Halliburton Oil Well Cementing Co.'s electrical-well-services operators are returning to classrooms at Halliburton's EWS research laboratory at Houston.

Each electrical-well-services operator spends 8 weeks at the Houston laboratory reviewing basic, applied and advanced theory with research personnel and works with both laboratory and regular field equipment for logging and other EWS services. Individual attention to service problems in each operator's area is another feature.

Halliburton operators from American, Canadian, Latin American, Carribbean, European, Mid-Eastern, and Far Eastern areas attend the schools.

Pacific Western Is Host For Oil Base Mud School

Drilling, production, and mud engineers from Imperial Oil, Ltd., Texaco Exploration, Stanolind Oil & Gas, and Shell Oil Co. recently attended a week-long mud school conducted jointly by Oil Base, Inc., Compton, Calif., and



Line-up of 6-cylinder Cooper-Bessemer V-angles in one of the pumping stations serving a large water-flooding recovery project.

A typical exterior view of one of the pumping stations.

Another Example of Efficient Power at Lower Cost

How COOPER-BESSEMER V-ANGLES *help collect a PLUS bonus...in oil*

● In most any important project requiring reliable pumping service, you're more than apt to find Cooper-Bessemer V-angles on the job . . . favored because they have so thoroughly proved their smooth performance, economy and low maintenance.

For example, a huge water flood project, expected to produce many millions of bonus barrels of oil, recently got underway in a major field. Twelve 6-cylinder Cooper-Bessemer V-angles have been installed for high pressure service. Two additional Cooper-Bessemer 4-cylinder V-angles, are handling low pressure distribution.

Besides outstanding performance, Cooper-Bessemer V-angles offer exceptional interchangeability of parts — a decided and welcome advantage in any large operation. Add it *all* up and it means unmatched return from every dollar invested in Cooper-Bessemers. Let us help you work out your future plans.

MOUNT VERNON, OHIO
COOPER-BESSEMER
GROVE CITY, PENNA.

New York City • Seattle, Wash. • Chicago, Ill. • Houston, Dallas, Greggton, Pampa and Odessa, Texas • Washington, D. C. Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. Caracas, Venezuela • COOPER-BESSEMER OF CANADA, LTD., Edmonton and Calgary, Alberta, Canada.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

Pacific Western Mud Service, Ltd., OBI's exclusive Canadian distributor Classes were held at Pacific Western's labs in Calgary.

Jack Long, vice president and assistant general manager of Oil Base, conducted the series of lectures, assisted by Clint Buffington, chief engineer of Pacific Western Mud.

During the four sessions, students participated in lab tests, analysis, and evaluation of drilling fluids. Subjects included the history, development, and improvements in oil-base muds, factors affecting their use, and special problems, such as handling of muds at subfreezing temperatures.

Casualty Insurance Firms Appoint P. L. Holloway

P. L. HOLLAWAY

The appointment of Philip L. Holloway as advertising manager of Texas Employers' Insurance Association and Employers Casualty Co. has been announced by B. J. Pittman, Jr., vice president in charge of public relations. Holloway has been with the companies 4 years. Previous to his assignment to advertising manager, he did sales promotion work for the companion insurance firms. His new duties will include handling all phases of advertising and public relations.

Bovaird Promotes Robertson and Brown

William F. Robertson has been promoted from store manager at Oklahoma City to Oklahoma district manager for Bovaird Supply Co. Paul M. Brown

ROBERTSON

P. M. BROWN

has been advanced to manager of Bovaird's Oklahoma City store. These changes have been announced by W. J. Bovaird, general manager of stores.

The Oklahoma district office at Oklahoma City supervises all phases of the company's operations and sales for six stores and one sales office at Oklahoma City, Seminole, Pauls Valley, Duncan, Sapulpa, and Pawhuska.

Robertson joined Bovaird in 1934 and has been promoted through all departments of store and field sales operations. He succeeds F. J. (Doc) Robbins, who was named manager of the tubular department in the Tulsa office.

Brown was first employed in 1941 at the Benton, Ill., store. He worked up through field sales to store manager at Ringwood, Okla. He succeeds Robertson, who was recently made Oklahoma district manager.

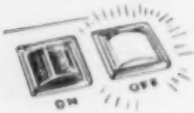
Vernon Manages Canadian District for Continental

Continental Supply Co. has opened a new Canadian sales district and has appointed Frank S. Vernon as the district manager. The new district's headquarters will be at Edmonton, Alta.

Vernon has been a Continental employe for 18 years. He has been active in sales and management positions in the Arkansas-Louisiana-East Texas-Mississippi division.

The new district is comprised of Continental stores in Edmonton and Drayton Valley, Alta.; Dawson Creek, B. C.; and Lloydminster, Alta.-Sask. Continental stores at Estevan and Virden will continue under the supervision of E. M. Fetzer, managing director, at Calgary.

HOW PENN SAFETY CONTROLS PROTECT YOUR ENGINES

Overheated cooling water and lubricating oil pressure failure can occur in the best of engines. When they do, costly damage develops if they aren't stopped quickly. And, that's exactly why Penn Engine Safety Controls are being installed on more and more engines. At the first sign of these troubles, the control warns you in one of three ways — you choose the one you want. The control will sound an alarm . . . or shut down the engine  . . . or flash a signal light. Then the fault can be corrected before it becomes expensive. Ask your jobber about this low-cost protection.

PENN CONTROLS, INC. Goshen, Indiana

Automatic Controls For Heating, Refrigeration, Air Conditioning, Gas Appliances, Pumps, Air Compressors, Engines

W-K-M Appoints Four Sales Managers

The appointments of Paul D. Nerren, Bart R. Braznell, M. J. Conley, and William A. Gormley as sales managers for W-K-M Manufacturing Co., Inc., of Houston have been announced by B. J. Gross, vice president for marketing. These men will be sales managers for the pipeline valve department, Key products department, drilling and production valve department, and the ACF lubricated plug valve department.

P. D. NERREN

B. R. BRAZNELL

Nerren started with W-K-M in 1934 and was promoted from the valve assembly line to sales and service in 1947. Braznell was with the former Key Co. for 26 years. He started as a draftsman, was made chief engineer, and in 1955 became sales manager.

M. J. CONLEY

W. A. GORMLEY

Conley has been with W-K-M for 10 years as sales representative in the Gulf Coast area. His headquarters are in the new W-K-M plant in Missouri City, Tex. Gormley was with the former ACF valve division for 20 years, serving as sales manager for 19 years of that period.

Dowell District Engineers Hold Meeting in Tulsa

Dowell Incorporated's district engineers from nine states, Canada, and Venezuela held a 2-day meeting recently to discuss the company's oil-field services and products.

Dr. W. W. Love, director of research for Dowell, presided at the first session. Engineers who presented papers and led discussions were R. E. Hurst, Midland, Tex.; Fred Rugg, Oklahoma City; S. R. West, Wichita, Kans.; J. E. Reed, Tulsa; George Gore, Denver; Ray Davidson, Borger, Tex.; J. A. Harmon, Wichita Falls; Dr. R. B. Rosene and E. J. Echols of Tulsa.

Subjects for discussion included formation fracturing, cementing, water flooding and secondary recovery, plugging and sealing agents, corrosion, paraffin removal, wire line and other equipment and drilling.

Also participating in the meeting were: J. L. Sluder, Pauls Valley, Okla.; J. L. Elbel, Kilgore, Tex.; R. D. Murphee, Houma, La.; B. A. Hodges, Caracas, Venezuela; Russell Norwood, Mount Pleasant, Mich.; H. G. Frizzell, Shreveport; L. B. Otte, Mount Carmel, Ill.; J. K. Crane, Salem, Ill.; C. G. O'Connor, Eureka, Kans.; R. A. Joekel, Alice, Tex.; R. C. Cameron, Edmonton, Alta.; J. E. Turner, Farmington, N. M.; J. E. Franks, Midland, Tex.

J. L. Trittipo, Marietta, Ohio; J. P. Moran, Houston; W. M. Thorvaldson, Calgary, Alta.; J. W. Fulton, Gainesville, Tex.; W. L. Sallee, New Orleans; G. A. Friesen, Sterling, Colo.; A. J. Palfrey and J. B. Stewart of Midland, Mich.; Warren Zingg, Dana G. Hefley, C. L. Lunsford, Claude Groom, and J. K. Henderson of Tulsa; Jack Sutherlin, Wichita Falls; and L. A. Courter, Oklahoma City.

It takes modern equipment to find, produce and transport oil as fast as present demands require. It also takes modern oil field housing to satisfy families of workers. In order to make a better team in the oil fields you need good equipment plus modern housing for workers. STURDYBILT pioneered "city home" housing in oil field camps. STURDYBILT has kept pace with new designs and construction, and is STILL your best buy in oil field housing.

■ MANUFACTURERS OF SPECIAL MILLWORK: DISTRIBUTORS OF CURTIS WOODWORK AND JOHNS-MANVILLE BUILDING MATERIALS.

STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

phmi

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS122 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

The correlation presented as Figure 1 shows how temperature varies with time at constant pressure level and illustrates the fact that as temperature approaches a level of 1,000 degrees Farenheit, its rate of change with time was not as great. Cross plotting of the pressure parameters in Figure 1 results in Fugure 2, which demonstrates the effect of variation of pressure with time at constant temperature.

The effect of catalyst concentration on conversion of n-butane reactant to isobutane is shown in Figure 3, which indicates conversion as a function of temperature with constant residence time and pressure held at constant values. The effect of residence time may be determined by taking the constant pressure parameters and plotting points from them as shown in Figure 4 which determines the effect of this variable at constant temperature and residence time.

In conclusion it may be inferred that, if all the data points are accorded equal values, conversion of n-butane reactant to isobutane product increases with increase in temperature, and decreases with increase in pressure, and increases with increase in residence time.

1. This is the first page of a manuscript for The Oil and Gas Journal as submitted by an outside author. Buried somewhere is the topic—increasing the yield of isobutane.

Is this important? (Secondary variable.) Check with author. B.Z.

The correlation presented as Figure 1 shows how temperature varies with time at constant pressure level and illsutrates the fact that as temperature approaches a level of 1,000 degrees Farenheit, its rate of change with time was not as great. (Cross plotting of the pressure parameters in Figure 1 results in Fugure 2, which demonstrates the effect of variation of pressure with time at constant temperature.)

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In conclusion it may be inferred that, if all the data points are accorded equal values, conversion of n-butane reactant to isobutane product increases with increase in temperature, and decreases with increase in pressure, and increases with increase in residence time.

2. Above is the same manuscript after The Journal's engineering editor reviewed it for publication. The notations are about certain points he wants to clarify with the author.

How technical articles are

10 ways to write to be read

1. *Keep sentences short* — from 16 to 20 words per sentence.
2. *Use simple instead of complex . . .* words clauses, sentences, context.
3. *Use familiar words;* use a little word in preference to a big word.
4. *Avoid unnecessary words* — make every word carry its own weight.
5. *Use action verbs* — instead of passive verbs.
6. *Use understandable, "picture" words* — concrete words that stand for things you can see and touch. Avoid abstract words and terms.
7. *Use "conversational" writing*—to avoid stuffy, technical jargon.
8. *Use variety;* avoid stilted, monotonous patterns. Write lively and colorfully.
9. *Use familiar writing . . .* compare new ideas with familiar ideas.
10. *Write to EXpress, not to IMpress.* Remember that "big men use little words; little men use big words."

Technical men, field men, and management men all read The Oil and Gas Journal

Here's how Journal editors write and *rewrite* material for effective presentation

What's the best way to write an engineering article? The trick is to make complex technical copy easy to read — without oversimplifying it. The manuscripts illustrated above show the progression of an Oil and Gas Journal technical article as it went through a "distillation process" in The Journal's editorial offices.

The engineering editor returned the manuscript to the author for clarification of some technical details.

The presentation editor suggested certain revisions, such as inverting one or two paragraphs. He also eliminated some excess wording.

~~The correlation presented on~~ Figure 1 shows how temperature varies with time at constant pressure level. ~~and illustrates the fact that~~ as temperature approaches ~~a level of~~ 1,000° F. ~~degrees Farenheit, the~~ rate of change of temperature with time ~~was not so great.~~ decreases. Cross-plotting of the pressure parameters in Figure 1 results in Fig. 2, ~~which demonstrates the effect of variation of~~ This shows how pressure varies with time at constant temperature.

The effect of catalyst concentration on conversion of n-butane ~~reactant~~ to isobutane is shown in Figure 3, ~~which indicates~~ This shows the conversion as a function of temperature ~~with~~ at constant residence time and pressure. ~~held at constant values.~~ The effect of residence time ~~may be~~ is determined by taking the constant pressure parameters and plotting points from them as shown in Figure 4, ~~which determines~~ These curves show the effect of this variable at constant temperature and residence time.

Examination of these figures shows that conversion of n-butane to isobutane ~~In conclusion it may be inferred that, if all the data points are accorded equal values, conversion of n-butane reactant to isobutane product~~ (1) increases with ~~increase in~~ temperature, ~~and~~ (2) decreases with ~~increase in~~ (3) pressure, and increases with ~~increase in~~ residence time.

This still reads a bit foggy. Let's try for a complete rewrite, maybe getting the thought in the last paragraph in at the beginning, and identifying the descriptions.

Maybe the rewritten version will yield a clock — letting the nontechnical reader "sample" the article.

(Eng. Dept.) — N

3. When the article is returned, The Journal's presentation editor edits the manuscript for "readability" — simplicity and language accuracy.

You can increase the yield of isobutane from n-butane by raising the temperature and slowing down the rate of throughput -- provided you don't let the pressure increase.

Why this is so is shown in Figs. 1, 2, 3, and 4.

Fig. 1 shows how temperature varies with time at constant pressure level. The correlation illustrates that the temperature increases less per minute as it gets close to 1,000° F. These pressure parameters were crossplotted in Fig. 2, thus demonstrating the effect of variation of pressure with time at constant temperature.

Fig. 3 shows the effect of catalyst concentration on conversion of n-butane to isobutane. It illustrates the extent to which temperature alone causes the reaction when both time and pressure are kept constant.

A method for determining the effect of reaction time is given in Fig. 4. Plotting points were taken from the constant pressure parameters, and they show what happens when the pressure changes but when both temperature and time are kept constant.

This is OK now. Believe it's simpler, and easier to read. The first sentence will make a good clock.

— N

4. This is the completely rewritten version as it finally runs in The Oil and Gas Journal. It is now simple, clear, and accurate, but it is still in an "engineer's language."

edited for easier reading...

The final version is "simpler and easier to read," and thus is an effective article for both technical *and* general readers.

Good technical publication writing is a field in its own. Articles are not written like a novel, nor a report, but like a news story — where the most important facts are summarized first; the details and background information follow. Unnecessary words are eliminated. Short words are used in favor of long words. Familiar, readily understood, pertinent, and concrete words are used.

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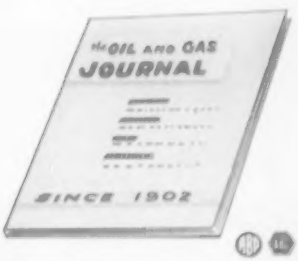
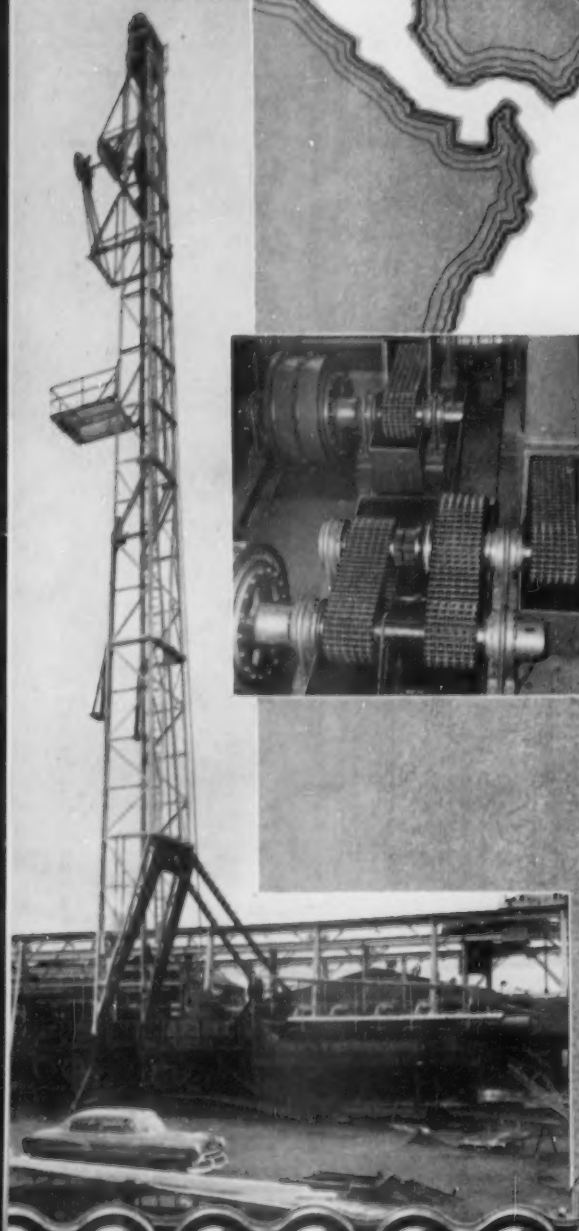


THE OIL AND GAS JOURNAL TULSA, OKLAHOMA

DOWN TO VENEZUELA GO DIAMOND ROLLER CHAIN DRIVES ON THE NEW TRAILER-MOUNTED UNIT RIG-15

VENEZUELA



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EXPLORATION

Red Earth Marks Time Until Freezeup

by Frank J. Gardner

This simple christmas tree marks the location of Union Oil Co. of California's Red Earth 12-17, an isolated strike in northern Alberta. Its completion in February 1956 set off the greatest land grab in Canadian history, but its real importance is yet to be determined.

THE greatest leasing spree in Canadian history was set off last February when Union Oil Co. of California found oil at Red Earth. The discovery well, Union's Red Earth 12-17, was in unsurveyed territory in theoretical LSD 12, 17-87-8w5, in North Central Alberta. It was far removed from previous areas of oil exploration or production, and plenty of unreserved land was there for the taking.

When the wildcat came in for 930 bbl. per day, landmen swarmed over all of eastern Alberta and western Saskatchewan. Within 2 weeks' time, they took reservations on 9 million acres in Alberta and 6 million in Saskatchewan. It was a protection play, based on the belief that a granite-wash trend was in the making clear across the two provinces.

An inaccessible discovery . . . Granite-wash pools had been found in Alberta before, but this one pointed in a new direction. Canadian operators are well aware of the tricky nature of the wash as a pay horizon. And Union Oil is still uncertain about just what it has uncorked at Red Earth. The second well in the area, Union's Red Earth 14-8, 5 miles north of the discovery was dry. Further drilling must now await the winter freezeup, for most of the region is inaccessible at this time of year.

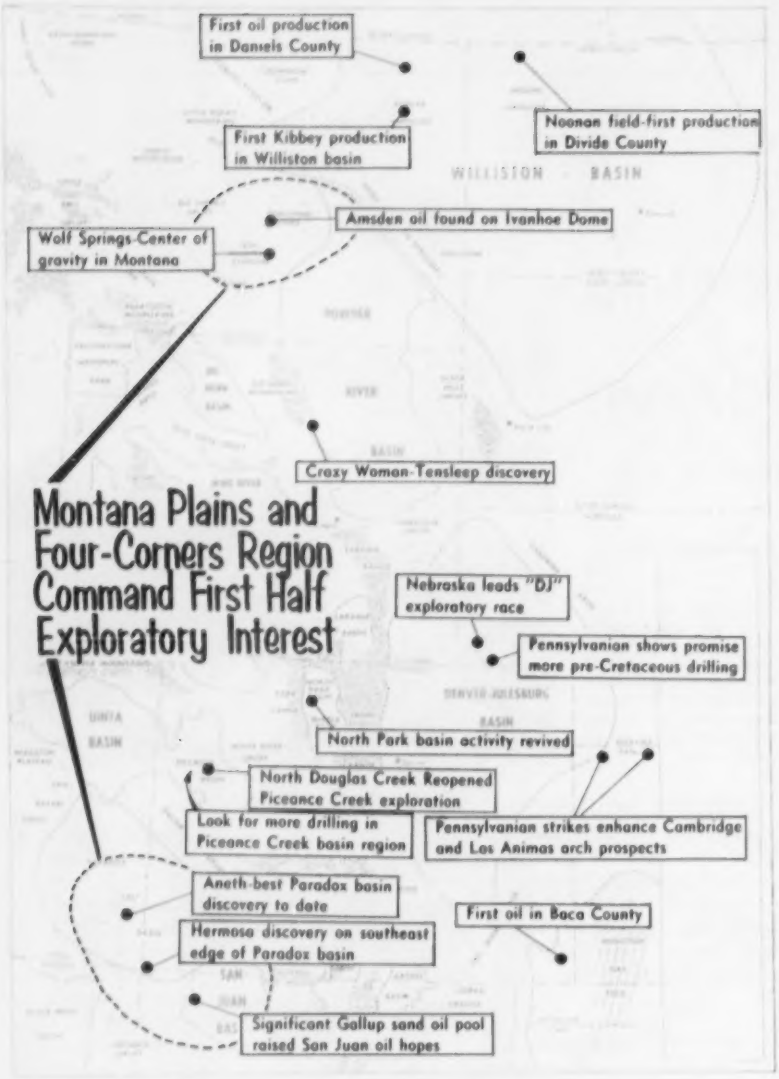
The discovery was serviced from Peace River, 132 miles southwest of the rig, and 6 hours away by car. Everything needed for the operation, except water, had to be trucked over those 132 miles, 100 of which are by winter bush road. All the oil produced from the discovery well (about 5,000 bbl. before the spring thaw forced the operators to shut it in) had to be trucked out by the same road. These bush roads can be constructed fairly easily by a bulldozer when the muskeg is tightly frozen, but when the thaws come, they become impassable and remain that way until the freezeup, which may be as late as the end of December.

Of unknown importance . . . So the true importance of this discovery will not be known for some time yet. Whether it is a major field, or a very local accumulation, can only be determined by further testing

The original location was made on combined geology and geophysics. It spotted 62 miles northeast of the nearest oil well and 100 miles from the nearest granite-wash well. Four dry holes had previously been drilled within a radius of 20 miles of the strike, and three of these had reached the granite wash. The venture was a true wildcat gamble. Regent Drilling Co. spudded it on January 2, 1956, and tapped the 50-ft. granite-wash pay early in February at 4,746 ft. Drill-stem test was run over the interval 4,740-65 ft. Gas came to the surface in 7 minutes at a rate too small to measure, and oil surfaced in 15 minutes. Flowing pressure was 1,275 psi. and shut-in pressure was 2,275 psi. in 30 minutes. Diamond coring was started at 4,765 ft. and continued to total depth of 4,797 ft. in granite topped at 4,780 ft.

Operators ran two more tests at 4,762-71 ft. and 4,771-97 ft., and results were similar to the first test. Production casing was run to 4,796 ft. and perforated at 4,766-80 ft. and 4,744-59 ft. The well was placed on production on February 13, with a potential of 930 bbl. per day through 20/64-in. choke. The oil is sweet, greenish-brown, 38°-gravity, with a gas-oil ratio of only 160:1. Tubing pressure on completion was 500 psi. and casing pressure was 745 psi. No water was detected.

Is typical of many . . . This operation is typical of many in western Canada —an isolated strike cradled in a nest of muskeg, the Canadian operator's greatest enemy. If some way to conquer the stuff can be devised, Canada's exploration pace would skyrocket. Several researchers are at work on the muskeg problem, and it may well be that the next few years will bring an answer. But meanwhile, Albertans must be content to drill in the winter and take to the hills in the summer. At that rate, it may be several winters before the true significance of Red Earth will be known. The pessimists contend that it's a freak occurrence, and that the land grab was unjustified. The optimists contend that it's a major discovery. Union hopes for the best while waiting for the freezeup.


First oil production in Daniels County
First Kibbey production in Williston basin
Noonan field-first production in Divide County
WILLISTON BASIN
Amsden oil found on Ivanhoe Dome
Wolf Springs-Center of gravity in Montana
Crazy Woman-Tensleep discovery
Montana Plains and Four-Corners Region Command First Half Exploratory Interest
Nebraska leads "DJ" exploratory race
Pennsylvanian shows promise more pre-Cretaceous drilling
DENVER-JULESBURG BASIN
UINTA BASIN
North Park basin activity revived
North Douglas Creek Reopened
Piceance Creek exploration
Look for more drilling in Piceance Creek basin region
Pennsylvanian strikes enhance Cambridge and Las Animas arch prospects
Aneth-best Paradox basin discovery to date
First oil in Baca County
Hermosa discovery on southeast edge of Paradox basin
Significant Gallup sand oil pool raised San Juan oil hopes

New drilling and discovery records anticipated as . . .

Rocky Mountain Activity Focuses on Two Hot Spots

by John C. McCaslin
District Editor

THE Rocky Mountain province can look back on the first 6 months of 1956 as a period of intense interest in both old and new-producing areas. Looking ahead into the remainder of the year, the industry appears headed for new drilling and discovery records throughout the mountain country. There definitely will be a concentration of oil hunters in the Four Corners and Montana Plains areas.

There are hopeful indications of a new-drilling push into the deep unknown of the vast northwestern Colorada Piceance Creek and associated basins. The Cretaceous campaign in western Nebraska will remain on top in the Denver-Julesburg basin race. There will be a sprinkling of pre-Cretaceous holes drilled on and around the Las Animas and Cambridge arches. Each year has its drilling excitement in the Rockies, and 1956 will be no exception.

Utah leads . . . Recent Pennsylvanian-oil discoveries in the remote Paradox basin of southeastern Utah have provided a much-needed exploratory accelerator to this highly regarded future oil province of the nation.

. . . Aneth. This San Juan County, Utah, area is likely to be the exploratory highlight of the year in the Rocky Mountain province. The Texas Co.'s 1 Navajo Pennsylvanian discovery flowed 1,704 bbl. of oil per day, the biggest gage yet recorded in the Paradox basin. The confirmation well and three additional producers have been added to the fast-growing field.

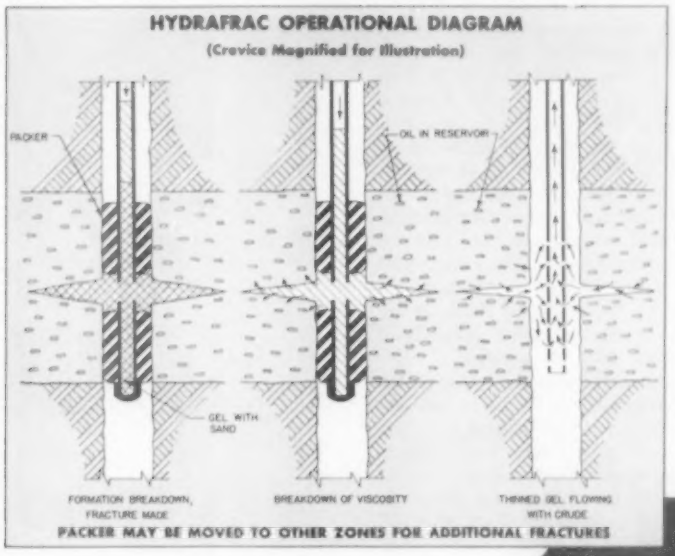
. . . New Mexico. The latest oil discovery that commands a fresh look at the potentialities of the Paradox basin is Humble Oil & Refining Co.'s Pennsylvanian hit at 1-B Navajo in the northwest corner of San Juan County, New Mexico. This field-opener, 25 miles southeast of Aneth, flowed 385 bbl. of oil per day on ½-in. choke from perforations at 5,608-32 ft. Location is on the southeastern edge of the Paradox basin.

Four Corners development is expected to increase during the summer and fall. Interest is highest at Aneth and in the Marye and Bisti areas of the San Juan basin in New Mexico. Recent Gallup sand discoveries in these two New Mexico areas have greatly improved the oil potential of northwestern New Mexico. Announcement of a new refinery at Gallup has added further heat to the oil fever in this region.

Montana discovers . . . This northern Rocky Mountain state is justly proud of its first 6 months of exploration this year.

The brightest spot on the Montana exploratory scene is the Central Montana Plains where the most significant developments since Poplar field's birth are taking place at Wolf Springs and Ivanhoe dome. Wolf Springs, a 1955 discovery, is developing into a major Montana producing area. Half a dozen good oil wells have been completed in this Amsden-basal Pennsylvanian-dolomite reservoir with new locations being announced weekly.

Closely associated with the Wolf Springs story is R. P. Oliver's recent Amsden-Heath transition discovery on the Ivanhoe dome in Musselshell County. This well was completed for 235 bbl. of oil per day on small choke. Location is 9 miles west of Northwest Sumatra, another Amsden producing


HYDRAFRAC OPERATIONAL DIAGRAM
(Crevice Magnified for Illustration)
PACKER
OIL IN RESERVOIR
GEL WITH SAND
FORMATION BREAKDOWN, FRACTURE MADE
BREAKDOWN OF VISCOSITY
THINNED GEL FLOWING WITH CRUDE
PACKER MAY BE MOVED TO OTHER ZONES FOR ADDITIONAL FRACTURES

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area. The success at Wolf Springs and Ivanhoe dome will lead to a new era of exploration on the Central Montana Plains.

. . . Repeat. The first important discovery of the year in the Williston basin was made at Ohio Oil Co.'s Repeat area wildcat, Carter County, Montana. The 1 Government, 4-1s-62e, flowed 60 bbl. of oil per hour from the Red River-Ordovician. This significant strike is 19 miles south of Little Beaver field on the southwest flank of the Cedar Creek anticline. The confirmation well was a failure, however.

. . . Daniels County. Late in May, California Co. tested its 1 Paulson in Daniels County, 1½ miles north of Bredette field, for 8 bbl. of oil per hour from the Charles-Mississippian, promising first production for the county.

Other Williston news. Other exploratory events in the Williston basin includes opening of first production in Divide County, North Dakota, at a Phillips Petroleum well. The discovery opened Noonan field.

Murphy Corp. 63 East Poplar Unit, Roosevelt County, Montana, was an important new-pay discovery for Montana and the Williston basin. The well flowed 63 bbl. of oil per day from the Kibbey sand, a lower member of the Big Snowy group of Mississippian age.

Exploration on the march . . . Although Montana and the Four Corners region held the commanding lead in exploratory success in the Rockies during the first half, other regions tapped important new reservoirs in both old and new wildcat country.

. . . Denver-Julesburg basin. Exploratory interest in this basin is shifting back to its birthplace, western Nebraska.

Activity in Nebraska has been intensified in recent months, a trend that is noticeable because of nearly 3 years of neglect to that portion of the basin while operators concentrated greater force on the oil search in northeastern Colorado. Both completions and production are at all-time highs in western Nebraska.

Morrill County appears headed for the top among leading Nebraska producing counties as a result of new discoveries this year. Three fields have been opened in this newcomer to Nebraska producing areas this year. Another eye-opener was Shell Oil Co.'s 1 Horn discovery in Banner County, 8 miles north of Olsen field. This "J" sand oil strike moved Nebraska production to its northernmost point.

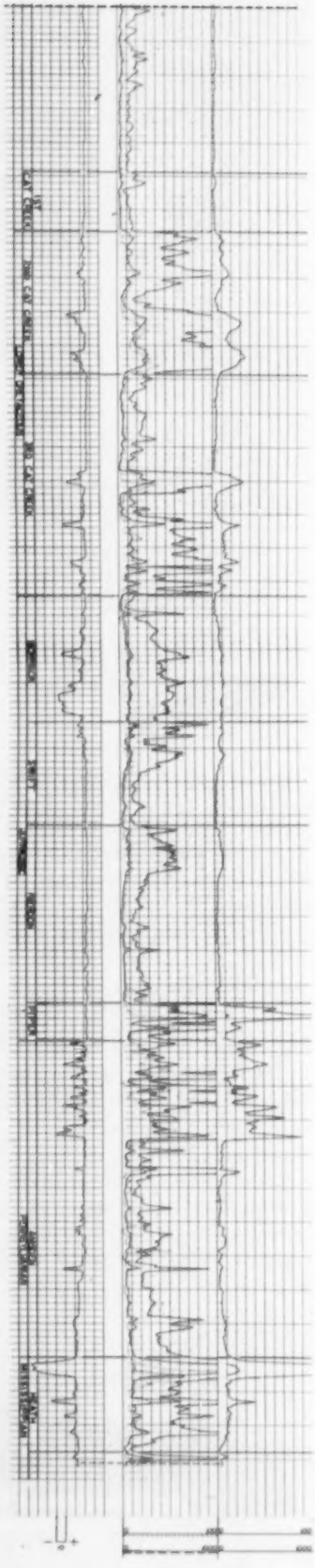
The pre-Cretaceous drilling heat is on again in the Denver-Julesburg basin. In Weld County, Colorado's Pierce field, California Co. reported 60 ft. of apparently productive Permian-Lyons sand. The indicated pay zone was tested in June. Shell drilled a deep test in Travis field, Kimball County, Nebraska. This well, now plugged, tested oil in the Pennsylvanian rocks at about 7,200 ft., the first in western Nebraska to find oil shows this far down the column. These deep tests in the Denver-Julesburg area are exploratory signs of the times. Their important findings may lead to more deep exploration on the northeast flank of the basin where pre-Cretaceous possibilities are expected to be the greatest.

. . . Southeast Colorado. The Colorado portion of the Hugoton embayment of the Anadarko basin got its first indicated oil production from a Baca County wildcat. Provincial Oil Co. recovered 270 ft. of clean oil from the Marmaton-Pennsylvanian lime at 4,100 ft. Location is 8 miles southwest of Greenwood gas field.

. . . North Park basin. A shallow gas discovery in this North Central Colorado basin revived slackened exploratory interest in this area, quiet since Battleship field was opened 4 years ago. Cabeen Exploration Co.'s Jackson County wildcat flowed 2,000 M.c.f. of gas per day.

. . . Piceance Creek. An all-important oil discovery for the future of drilling in northwestern Colorado was made by Phillips Petroleum Co. at its 1-A North Douglas Creek in Rio Blanco County, 15 miles northeast of Hells Hole Canyon. This Weber-Pennsylvanian discovery only made 92 bbl. of oil per day, but it lighted exploratory fires in Rocky Mountain oil circles. This basin, which is the home of famous Rangely field, has been inactive from the development standpoint for many years. A few months ago, the serene wildcat picture was changed when oil was discovered in the Weber sand at the Thornburg Unit.

As a result of these deep oil discoveries in northwestern Colorado, deep tests are becoming more and more apparent throughout the region. Deep holes are reported southeast of Rangely at Hells Hole, Sulphur Creek, and East Artesia. Leasing is heavy. The Piceance Creek region, although it is no newcomer to Rocky Mountain producing basins, is in line for real wildcat excitement soon when the deep wildcat drills begin to probe its depths.



TYPE ELECTRIC LOG of Montana Plains, one of the hottest exploratory areas in the Rocky Mountains. (Log courtesy Schlumberger Well Surveying Corp.). The geological information on the log was compiled by Schlumberger's Rocky Mountain area staff.

CALIFORNIA
OIL & GAS FIELDS
SACRAMENTO VALLEY GAS FIELDS
SAN JOAQUIN VALLEY OIL & GAS FIELDS
SANTA MARIA BASIN OIL FIELDS
VENTURA BASIN OIL FIELDS
LOS ANGELES BASIN OIL FIELDS

WHILE CONSIDERABLE INTEREST has been given California's offshore areas, there are some 1,200 geologists working the inland areas of the state.

56'ers less aggressive than 49'ers, but

Seers Point to the Sea as California's Best Bet

by Homer Steiny

THE great reward attained by companies successful in gaining offshore drilling permits naturally makes one who is forecasting the future of California look oceanward. Permission to develop the ocean has been tougher than getting the oil.

The grandsons of the hardy 49'ers now find themselves sitting in the sunshine, so complacent that they are satisfied with the way things are, and want for nothing more. Some of the cities are actually throwing their birthright down the drain so that their tender nostrils will not be irritated with gravity 25. Truly, gold would never be discovered today.

A ray of light does sometimes flicker through. The most recent one being that case exhibited by the brave citizenry of Redondo Beach who have voted to reduce their natural resources to money. It will redound to their benefit just as it has everywhere else. But what a task it is to penetrate the petrolific barrier! Those who work on elections and show city councils the light are the 49'ers of today.

As in all parts of the world, oil is found in sedimentary rocks, and of those rocks the Tertiary of California has been the major producer. There are a few exceptions, but the major expanse of Tertiary sediments in juxtaposition to the ocean are from San Luis Obispo County southward to the International Boundary. This includes San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties.

Author is consultant in petroleum geology, Los Angeles. Article first appeared in I.P.A.A. Monthly.

Continental Shelf Exploration

It is on the Continental Shelf off of these counties that most of the exploration is to be expected. It is here that the oil-minded companies have been conducting geologic and seismic surveys, all, of course, under water. These results are the confidential property of those making the survey.

However, a fair guess can be made by anyone experienced in the structure of California as to the possible general areas. These include the oceanward areas off Coon Creek in San Luis Obispo County; Surf, Point Conception, Refugio Beach, Hope Ranch, Santa Barbara, Montecito, Summerland, Loon Point and Carpinteria in Santa Barbara County; Rincon, Santa Clara River and Point Mugu in Ventura County; Point Dume, Santa Monica, Venice, Hermosa Beach, Redondo Beach in Los Angeles County; Seal Beach and Huntington Beach in Orange County.

Of somewhat less glamour, but still in organic-sedimentary areas are the tidelands off Cape Mendocino and Point Arena in Mendocino County; Drake's Bay in Marin County; and Davenport in Santa Cruz County.

In addition to the above, most of San Diego County and the sedimentary area off the mouth of the Eel River in Humboldt County have been touched by the offshore seismograph parties. These areas, however, lack generator rocks and are not looked at with as great interest as the others.

The Monterey Oil Co.-Texas Co. combination has been rather successful in combating the complacent 49'ers' grandsons and the ocean waves, and is actually producing from a synthetic island off the town of Seal Beach in water up to 50 ft. This sets an example of what is possible to do at many other locations along the coast.

New viewpoints . . . While considerable emphasis has been given to the offshore areas, let us not forget that some 1,200 professional geologists are engaged in the sedimentary areas of the state. These believe, and properly so, that many traps are yet to be uncovered. They are engaged in reviewing all the older drilling records, maybe interpreting into them a new viewpoint, especially by considering a recent well. They are restudying the electric logs and making other correlations.

They are restudying the seismograph records that were made during the days

when it was more blessed to turn out profiles than oil fields.

These men are working in the basins of California and have small local headquarters in such remote areas as Colusa, Chico, Sacramento, Santa Maria, Bakersfield, Santa Paula, Fillmore, Ventura, Santa Barbara, Brookdale, Half Moon Bay, and a few more spots that tend toward intensive study and away from the intricate maze of the "Head Office." They will surely develop hypotheses that will head the drills for the grease. These may be entirely new areas or rims of extension of an already partially developed oil field.

Other approaches . . . Work that will lead to similar results are the 14 seismograph parties and the 3 gravimeter parties that are going over and regoing over the sedimentary area of the state. Some minor advances have been made in these methods and more refinement will continue to be made, hence an unestimated amount of new oil is sure to result.

A method of drilling wells to around 4,000 ft. with the drilling rig located on an ocean-going boat is a very modern innovation in the oil-exploratory field. One major California company has been operating two boats with such equipment for a number of months and has several unproductive holes to its credit, while another major has been operating one.

Two majors are building this style of drilling rig and another is transferring one from Gulf Coast waters. These high powered, practical, expensive rigs could easily add a sizable amount of reserves to the state's wealth.

Surface work . . . Then there is the old first love of the geologist, the rocks that can be seen on the surface. This work has been well done. However, minor reinterpretation and small additions due to recent road cuts or other exposure can surely lead to exploratory drilling.

Northeastern Ventura County has a number of surface anticlines that have never had a hole drilled into them in the vulnerable spots. The Topatopa anticline is a big, broad arch plunging in all directions. It is in the Lower Tertiary series and has, therefore, been avoided by prospectors. However, small patches of Eocene production have been appearing on the face of the California map and sooner or later they will get to this and put a hole into its quaquaversal high.

But the real prize of this general area is the Coldwater anticline. Here, a big anticline 9,000 ft. thick in Eocene rocks could easily be full of oil. As a bonus for drilling it, one can go through the great San Cayetano overthrust and into the underlying Upper Tertiary series that has produced such a plethora of oil in this area.

True, the beds may be vertical due to the shove of the thrust, but the highly organic nature of the entire county will find rocks dipping at all angles with a plentiful volume of oil if they are covered, as they are found to be here.

Santa Cruz and San Mateo counties have desirable undrilled traps. They lie in a somewhat less organic basin, but are attracting the attention of the geologic fraternity at this writing.

Work to be done . . . And so, California does continue to offer many possibilities in all departments of the exploratory game. The hazards are a little more than they used to be, with the reward about the same. The barrier is the reluctance of today's citizens to grant the present 49'ers a spot on the "diggins." Truly, the voting citizens of Redondo Beach deserve congratulations and other locales must give birth to such staunch members for their city councils as did Redondo.

EXPLORATION HIGHLIGHTS

SOUTH TEXAS

UPPER GULF COAST

Marrs McLean Outpost Gets Large Gas Flow

Stanolind Oil & Gas Co. has completed a large gas well north of production in the Marrs McLean area, Jefferson County. Open-flow potential is calculated at 69,000,000 cu. ft. per day. Allowable production is expected to be 17,250,000 cu. ft. per day. The well is shut in with pressure on the tubing at 3,878 psi. Shut-in formation pressure is 4,887 psi.

Production is from the area's Hackberry sand with top of pay at 10,187 ft. Hole was drilled to 10,294 ft. and plugged back to 10,214 ft.

Location of the well, 1-C Marrs McLean, is about 4½ miles northeast of Hampshire, and about 2 miles northwest of Fannett field. Marrs McLean field adjoins Fannett on the west, but is separated by faulting. It is about 15 miles southwest of Beaumont. Clegg-Hunt interests of Houston are associated with Stanolind in the operation.

Liberty County Wildcat Opens New Wilcox Area

Hamman Oil & Refining Co., with F. W. Michaux and States Marine Corp. as joint operators, has uncovered a new Wilcox oil-productive area in northwestern Liberty County.

Its discovery well, 1 Douglas Smith, is 1½ miles northeast of McCoy field, in the Moses Donahoe Survey, 7 miles southeast of Cleveland.

Pay is perforated at 9,175-82 ft., with bottom of the hole at 9,292 ft. The well flowed clean 34°-gravity oil in a preliminary drill-stem test, open 8 hours through ¼-in. top and bottom chokes. It had its 550-ft. water cushion at the surface in 60 minutes, followed by oil 45 minutes later. Flow was under pressure of 2,950 psi. Shut-in pressure was 3,855 psi.

Old Big Creek Salt Dome Gets New Oil Reservoir

A new oil-reservoir is being opened on the old Big Creek salt dome, 10 miles south of Richmond, in Fort Bend County.

Its discovery is by Trice Production Co. at its 1 Hubert Hausler and others, in the Barnabus Wickson Survey, on the southwest side of the dome.

Pay zone is perforated at 3,660-68 ft. with hole plugged back from drilled depth of 4,440 ft.

On potential gage through ¼-in. choke, the well flowed at the rate of 133 bbl. per day with pressure of 150 psi. and gas-oil ratio of 400 cu. ft. per barrel.

SOUTH LOUISIANA

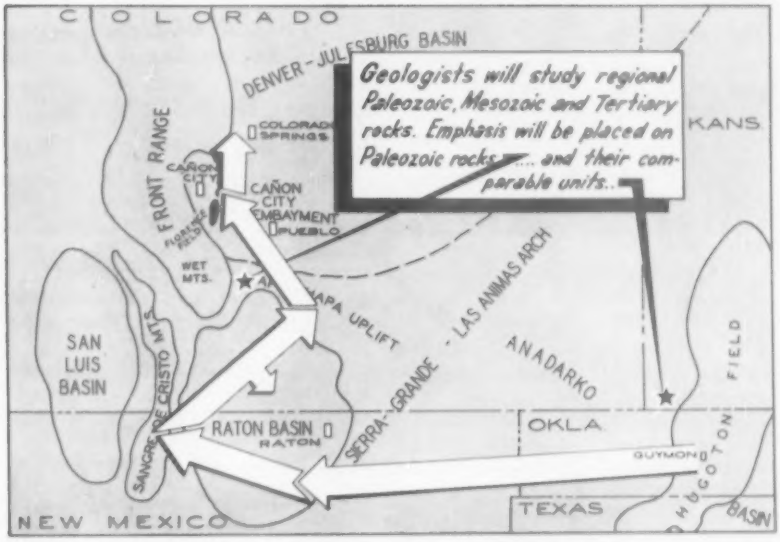
Two Outpost Tests Give Maxie Double Extension

Production at Maxie, in Acadia Parish, received a double extension last week.

Forest Oil Corp. jumped field limits a mile north at its 1 Higginbotham estate, completed as a gas-condensate well in pay at 11,152-70 ft. The well had flowing pressure of 7,925 psi. Shut-in pressure is 8,585 ft. Pay is new for the area.

Two miles southwest off the northwest flank of the field, Hassie Hunt Trust completed its 1 Daigle with gas-condensate production from perforated interval at 11,096-102 ft. It had flowing pressure of 7,500 psi. Shut-in pressure is 7,700 psi.

Forest's well was drilled at 11,992 ft. Hunt's well is bottomed at 11,530 ft.



The theme of the Oklahoma City Geological Society's September field trip will be a study of the Paleozoic rocks outcropping in the mountains of South Central Colorado, and their relationship to comparable units in the northwestern Anadarko basin.

Geologists to Study Wide Area

Field trip will consider Paleozoic rocks

THE Oklahoma City Geological Society will hold a field conference celebrating its thirty-fifth anniversary on September 20-22. The theme of this conference will be a study of the Paleozoic rocks outcropping in the mountains of South Central Colorado, and their relationship to comparable units in the northwestern Anadarko basin. The conference will also make a study of the tectonics and structural relationships in that basin and adjacent areas, and their contribution to and influence on sedimentation in the basin.

A secondary feature will be a study of the Mesozoic and Tertiary stratigraphy of the Oklahoma Panhandle, Dry Cimarron Canyon, and the Raton basin.

The conference guidebook will be dedicated to the late Dr. C. N. Gould, pioneer Oklahoma geologist, who did much of the early geological work in the northwestern Anadarko basin.

The conference will get under way in Guymon, Okla., for final registration September 19, leaving the next morning by private cars. The first night of the trip will be spent in Raton, N. M., the second in Pueblo. The trip will end in Colorado Springs Saturday afternoon, September 22.

Areas of interest to be studied during the conference are the Sierra Grande uplift, the Paleozoic section in the Sangre de Cristo Mountains, the Apishipa uplift, the Paleozoic section in the Canon City embayment of the Denver-Julesburg basin, and the Paleozoic section near Colorado Springs, including the Glen Eyrie formation, Morrowan in age. The Morrow is the main gas-producing sand of the northwestern Anadarko basin.

General chairman of the conference is B. W. Beebe, Keating Drilling Co., Oklahoma City. Trip leaders are Harry W. Osborne, consulting geologist, Colorado Springs; William Dixon Neiler, Ohio Oil Co., Casper, and Dr. Don B. Gould, Geophoto Service, Denver, son of Dr. Gould. The trip is timely because of the great interest and activity in the northwestern Anadarko basin.

Interested people should contact L. J. Beckmann, Champlin Refining Co., Box 1713, Oklahoma City.

SOUTH LOUISIANA

Second Pay Zone Opened In New Ponchartrain Field

Shell Oil Co.'s second well in the recently discovered West Lake Pontchartrain field, in Lake Ponchartrain, St. Charles Parish, is being completed as a gas-condensate producer in a sand more than 1,600-ft. shallower than that of the discovery well.

The new sand is perforated at 7,175-80 ft. Tests through 7/64-in. choke got a flow of 1,025,000 cu. ft. of gas and 3 bbl. of condensate per day. Pressure was 2,800 psi.

The well is half mile east of the discovery well, productive of gas from pay at 8,808-24 ft.

Location is about 2 miles offshore and about 4 miles north of Good Hope field.

Two Zones Produce In New Dalcour Discovery

Mecom Petroleums, Inc., is completing its discovery well on the Dalcour prospect, 10 miles southeast of New Orleans, in two Miocene sands, one at 10,036-42 ft. and the other at 8,937-42 ft. The well is Mecom's 2 Delacroix.

The lower zone, first tested, flowed at the rate of 322 bbl. of 38.2°-gravity oil per day through 5/32-in. choke with pressure of 1,175 psi. and gas-oil ratio of 575 cu. ft. per barrel.

The upper zone flowed 2,116,000 cu. ft. of gas and 50 bbl. of 56°-gravity condensate per day through 3/16-in. choke with pressure of 3,350 psi.

Hole had been drilled to 12,098 ft. and is cased to 10,967 ft. Mecom is starting another 12,000-ft. test a half mile southwest of the discovery.

The area in Plaquemines Parish is 4 miles east of Stella field, nearest production.

SOUTH LOUISIANA—OFFSHORE

New Shallow Gas Area Opened in Breton Sound

California Co. has another offshore new-field discovery. It is in Breton Sound, about 20 miles off the east side of Plaquemines Parish. Its discovery well, in Block 40, Main Pass Area, is productive of gas with pay at 3,478-88 ft. Flow on tests through 3/16-in. choke was at the rate of 3,310,000 cu. ft. per day with pressure of 1,225 psi.

The well was drilled to 10,000 ft. Deep sands failed to show for commercial production. Location is on State Lease 1262 (OCS 0373).

ARK-LA-TEX

EAST TEXAS

Deep Test Staked In Collin County

Humble Oil & Refining Co. has scheduled another deep operation for west-central Collin County, 4 miles northwest of McKinney, which places it about 1 mile northwest of their 1 Miller. The latter was drilled in 1954 to 11,407 ft.

The new well will be 1 J. L. Atkins,

located in the John McCarrah Survey, on a 76-acre lease. Projected depth is 11,500 ft. Humble's 1 Miller was said to have found gas shows around 9,000-9,480 ft. Formation markers were Woodbine sand 570 ft., Comanche 1,150 ft., and Travis Peak 2,562 ft. Other details of the test were withheld. Collin County does not have oil or gas production.

Anderson County Salt Dome Prospects Dimmed

One of the two prospective East Texas salt dome wildcats was given less chance for production.

The Texas Co. 2 Williams, Woodbine test on the Bethel dome in western Anderson County, swabbed 9 bbl. of oil in 12 hours, plus 16 per cent water from perforations at 5,622-27 ft. Perforations at 5,622-25 ft. swabbed 90 per cent water with 10 per cent oil. Operators had previously recovered 1,000 ft. of oil on a drill-stem test between 5,600-30 ft.

Wood County salt dome test . . . British American Oil Producing Co. 1 Weisenhunt, on the Hainesville salt dome, Wood County, was drilling ahead below 10,880 ft. at last report. This well showed for production from an 85-ft. Woodbine section between 9,356-9,450 ft.

Slocum Area Gets New Tests

Drilling in the North, South and West Slocum fields of Anderson County was given a new boost last week. Thomas D. Humphrey & Sons Ltd. staked locations for 4 new wells in the South Slocum area, all being 1 and 2 miles southeast of Slocum townsite.

Oil Properties, Inc. 2 Garrison Brothers, a 5,850-ft. West Slocum test, was located in the W. R. Wilson Survey, southwest of Slocum townsite.

B. F. Phillips Jr. made location for two 6,000-ft. tests in the North Slocum area.

ROCKY MOUNTAIN

WYOMING

High Flow Reported At Cottonwood Creek

A high oil flow rate was reported at Stanolind Oil & Gas Co.'s 13 Cottonwood Creek Unit in Washakie County. Perforations are at 6,806-22 ft. in Phosphoria. Most of the field's wells have had high flow potentials.

Another Extension Well Completed At San Arroyo

The second extension discovery at San Arroyo field in Grand County, East Central Utah, was completed by Sinclair Oil & Gas Co. The 3 Unit, NW SE NW 23-16s-25e, flowed 2,300 M.c.f. of gas per day from the Dakota sand; from the Entrada it made 16,450 M.c.f. per day.

This is the second extension discovery in the field. The discovery well, 1 Government-San Arroyo, located in NE SE NW 26-16s-25e, flowed 18,500 M.c.f. of gas per day from Entrada sand on completion. The 2 Unit well, SE SE NW 22-16s-25e, made 3,546 M.c.f. per day from the Dakota and 11,000 M.c.f. per day from the Entrada. Closest production is 3 miles south in Bar-X Unit field.

UTAH

Oil Reported On Tests At Bluff Unit Well

Shell Oil Co. reported recovery of 2,000 ft. free oil on a drill-stem test of

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the Paradox-Pennsylvanian at its 3 Bluff Unit wildcat, NE NW NW 4-40s-23e, San Juan County. Location of this important test is 6 miles northwest of the booming Aneth field area.

The test was made at 5,454-5,529 ft. The first well here was drilled 5 years ago.

COLORADO

Mesa County Discovery Testing Gas In Salt Wash

A Mesa County gas discovery, American Metals and El Paso Natural Gas Co. 4 Highline Canal, C NW NE 4-9s-103w, flowed an estimated 2,500 M.c.f. of gas per day from perforations at 2,544-64 ft. in the Salt Wash member of the Morrison.

Location is 2 miles west of Highline Canal field. That pool was opened 5 years ago by Amerada Petroleum Corp. for 1,329 M.c.f. per day from the Dakota.

Canadian River Well Dry

Cabeen Exploration Co. has quit at the second extension well to new Canadian River field in the North Park basin area of Jackson County, northern Colorado. The 1 "B" Blevins, NW SE NW 3-9n-78w, was plugged at 2,253 ft., total depth.

The discovery well in this new field, 1 Blevins, SW NE NW 11-9n-78w, flowed an estimated 6,000 M.c.f. per day from Muddy sand perforations. The 2 Blevins, NW SE SE 3-9n-78w, was a new-pay discovery from Dakota and Lakota, making 21,000 M.c.f. per day. Location of the field is 4½ miles east of North McCallum field.

WESTERN NEBRASKA

Fifth Well Staked At Lindberg Field, Morrill

Morrill County's third new field this year has its fifth well staked. Skelly Oil Co. will try for production at 5 Lindberg, NW SW SW 11-17n-52w.

The discovery well, 1 Lindberg, NW NW SW 11-17n-52w, pumped 330 bbl. of oil per day on completion. Location of the new field is 1½ miles northwest of Juelfs field, Cheyenne County, another "J" sand producer.

MONTANA

Piper Discovery Completed In Wolf Springs Field

Wolf Springs' new pay, the Piper lime of Jurassic age, becomes the second area in Central Montana with production from that zone. Atlantic Re-

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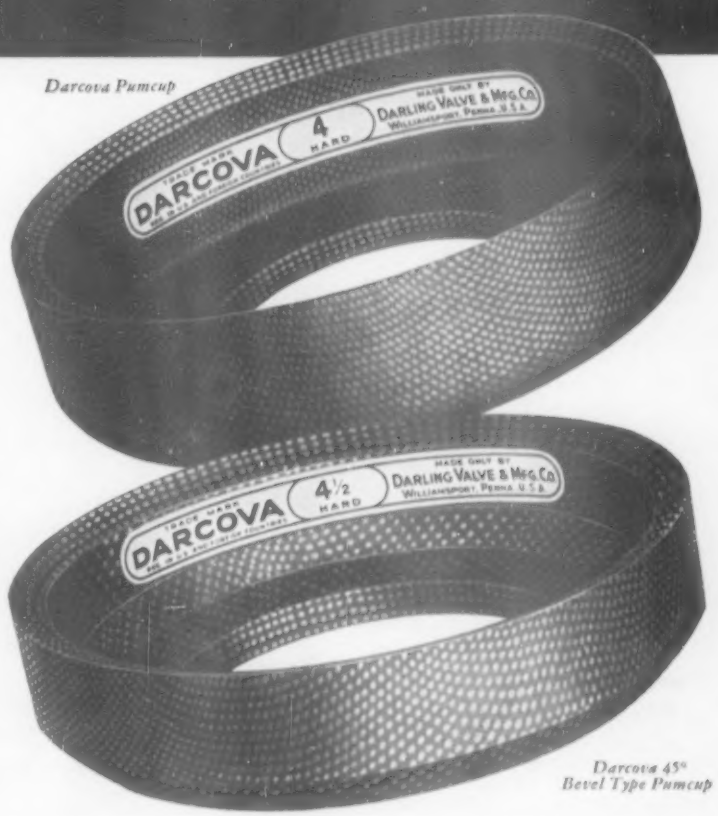

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fining Co. completed its 13-2 Horton estate discovery in C SE NE 13-7n-31e, Yellowstone County, for 256 bbl. per day from the Piper at 5,981-6,026 ft.; 417 bbl. per day from the regular pay, Amsden, at 6,030-66 ft. The flow from the Piper was on ¼-in. choke; Amsden on 12/64-in. choke.

There is one other Piper lime well in the general region. McAlester Fuel Corp. has one producing at Northwest Sumatra field.

Wolf Springs grows . . . Montana's newest field of major importance continues its rapid growth. Carter Oil Co. has two rigs running, Atlantic also has two. The field has 13 producing wells. The field is 4 miles long, 1½ miles wide.

SASKATCHEWAN

Imperial Oil Limited is currently acidizing and fracturing the Charles zone of the Mississippian at its Lampman 13-5 exploratory venture in southeastern Saskatchewan in an effort to complete it as a commercial oil producer from that zone.

PACIFIC COAST

CALIFORNIA

Humble Nears Fillmore Completion

Humble Oil & Refining Co. appeared to be nearly ready to join Standard Oil Co. of California with a producing well in the deep Fillmore field in Ventura County. Humble was setting 5½-in. casing to 13,790 ft. in the extension test, 1 Fillmore, located about ½ mile northeast of Standard's nearest producing well. Production in this field, located about 2 miles west of the town of Fillmore, has been the exclusive property of Standard up to this time.

San Mateo Wildcat Suspended

Americo Oil Exploration & Drilling Co. has suspended operations on 1 Americo-Cabral, a 4,000-ft. wildcat located 2 miles southeast of the town of San Gregorio in San Mateo County. Neaves Petroleum Development Co. was drilling below 4,007 ft. on a test in the mountainous LaHonda area of the county while Union was ready for the contractor at a site in the Peters Creek area. All three projects are located northwest of Union's Oil Creek discovery of late last year.

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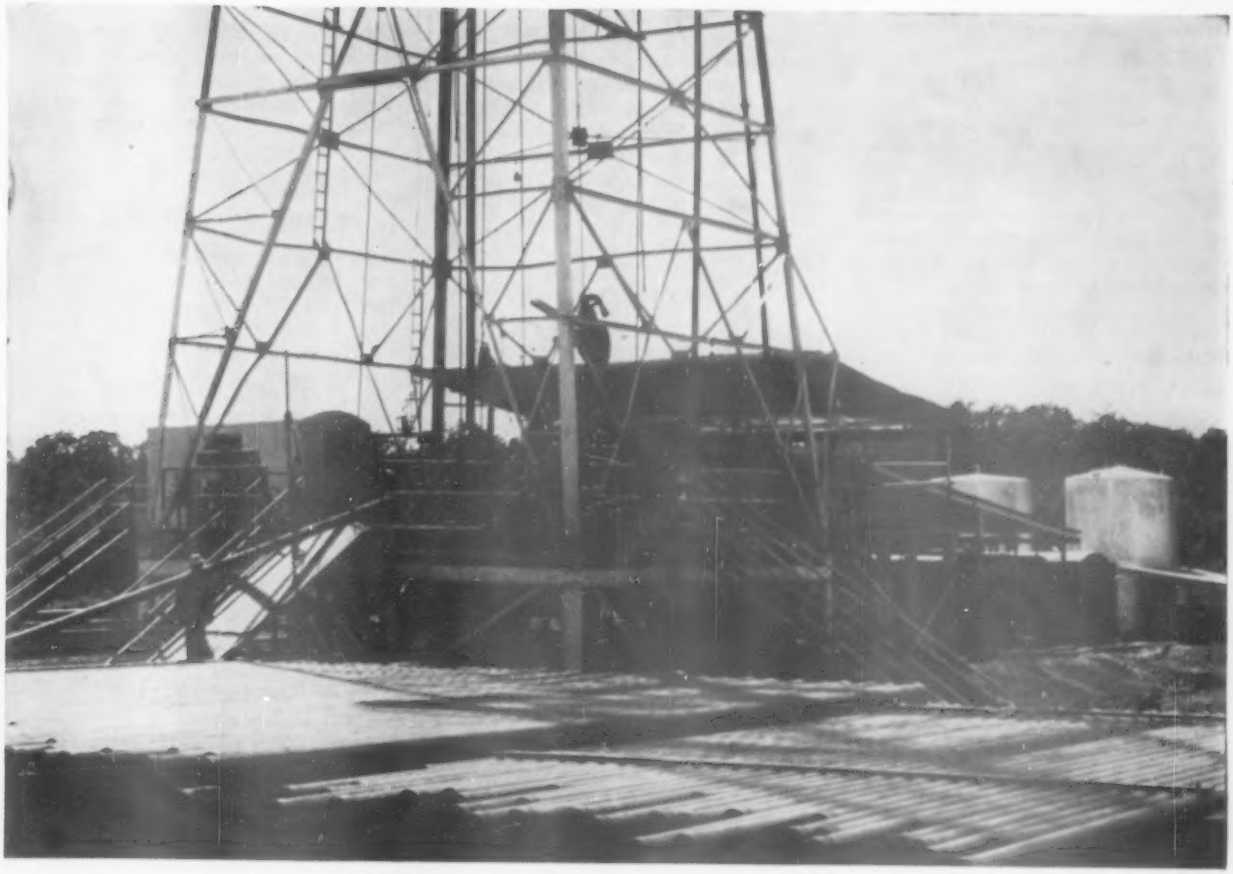

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Shell Has Good Test at Vallecitos

Shell Oil Co. reported 58-31 F & I, located more than a mile north of the Vallecitos field discovery in San Benito County, flowed 32°-gravity clean crude at an entry rate of 90 bbl. an hour on a recent 1-hour test of the interval 3,348-3,450 ft. Gas surfaced in 8 minutes and oil in 29 minutes. Shell was coring ahead below 4,114 ft.

Bankline Hits New Fault Block Production

Bankline Oil Co. scored a new fault block pool discovery more than 1 mile north of production in the Poso Creek field area of Kern County. Bankline ran 8⅝-in., including 100 ft. of 80-mesh perforations between 2,245-2,345 ft. in 1 De Pauli. Cores showed 12° to 14°-gravity crude. Total depth of the wildcat is 2,815 ft.

The Texas Co. Plans Tejon Eocene Test

The Texas Co. will drill a 12,000-ft. Eocene test in SE SW 32-11n-19w in the Tejon field of southern Kern County. Texaco's deep test site is in the midst of wells producing from shallower zones in the area. Standard Oil Co. of California drilled a 13,239-ft. Eocene wildcat a half-mile north of Texaco's proposed wildcat in 1953. Standard eventually plugged back the deep wildcat and completed it in the Santa Margarita.

Mariposa Nears Derby Completion

Mariposa Co. was preparing to complete 73-35 Kovacevich in the Derby sand at 7,968-8,018 ft. following a good test of that interval. The wildcat, located a little more than a mile south of the town of Arvin in southern Kern County, flowed at a test rate of 960 bbl. daily of 35-40°-gravity crude. Total depth of the well is 8,250 ft. Prior to completion, Mariposa planned to take sidewall samples of the Upper Chanac sand stringers at 5,800-7,000 ft.

Shell Gets Good Test On Another Strand Well

Shell Oil Co. 21-7 Posuncula-KCL in the Strand field, Kern County, flowed at a 960-bbl. daily rate on a recent 1 hour test of the interval 9,523-9,556 ft. This well, which will probably be completed in the Stevens zone, is a northeast offset to Shell's 111-7 Shell-TWA-Conoco-KCL which was recompleted in the Vedder last month at 12,440 ft. for 476 bbl. daily.

Getty Completes Second Big Santa Fe Zone Well

Getty Oil Co. completed its second prolific producer in the Santa Fe zone of the Santa Fe Springs field in Los Angeles County. Getty's latest success is 33 Nordstrom, a redrill of a well originally completed in 1929. Getty deepened the old well from 8,000 to 9,050 ft. It was brought in flowing 1,152 bbl. daily of 34°-gravity crude through a ½-in. choke from the perforated interval 8,020-9,047 ft. Earlier in June, Getty completed 52 Hill from 9,110 ft. for 963 bbl. daily. Both Getty wells are more than 1,000 ft. west and northwest of General Petroleum Corp.'s deep zone discovery well.

Tidewater Scores At Corral de Quati

Tidewater Oil Co. put 2 Orton on pump for initial production of 30 bbl. daily, 15 net of 16.6°-gravity crude.

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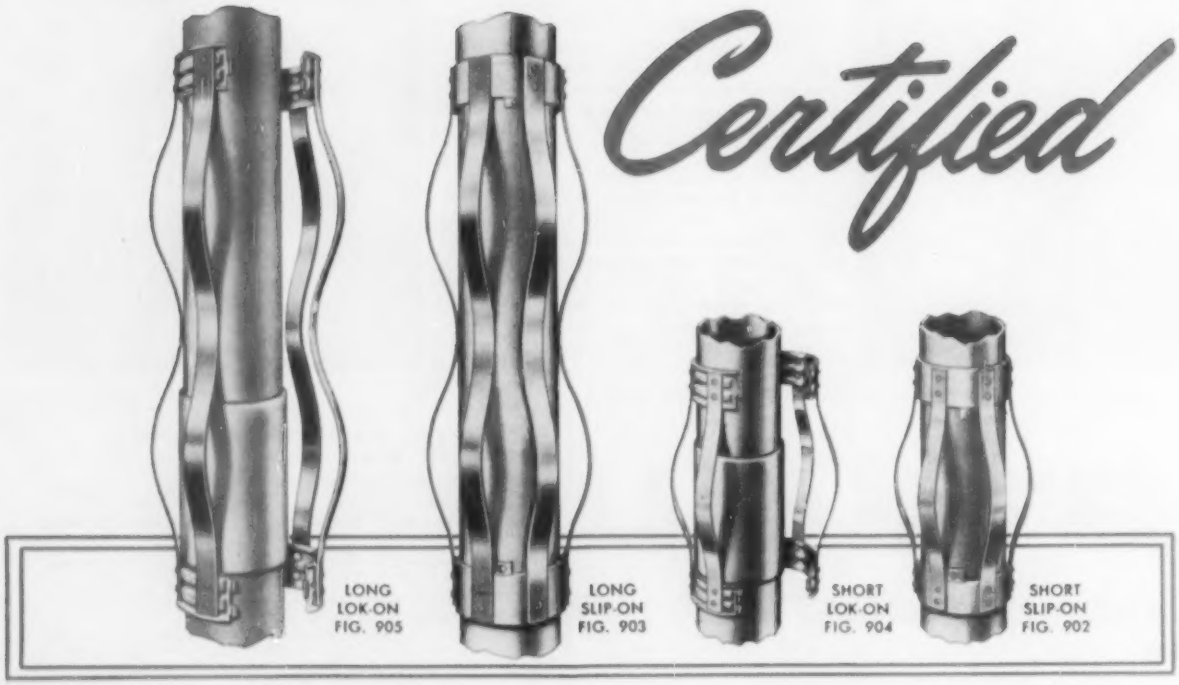

This well is located in the Corral De Quati area of Santa Barbara County and was originally drilled to 6,185 ft. and abandoned by Shell Oil Co. in 1951. Tidewater went back into the test and perforated the interval 5,077-5,892 ft. for the completion. It is located 10 miles north of Capitan field.

Signal Drilling Ahead On Third Redondo Test

Signal Oil & Gas Co. was drilling ahead below 5,140 ft. on 3 Redondo Beach, the third slant-drilled test of the city of Redondo Beach's submerged lands. A 1-hour formation test at 4,991-5,140 ft. recovered 3,830 ft. of oil and gas-cut mud.

GREAT LAKES

MICHIGAN

Two more typical Reynolds pool Dundee-Reed City oil producers were completed in the current period. Both new completions were scored by the discovery group. McClure, Swan-King, Basin Oil Co. and G. Ackermann. One of these new producers was of especial interest. It offset a much older Reed City objective test well in this area that was completed as a failure. Previously, this same failure was offset to the south by a good producer. New flowing offset to the older 1 Jack failure was the 1 A. Weikert, SE SW SW 6-12n-9w, Winfield Township, Montcalm County. Objective was drilled between 3,338-40 ft. Hole filled and flowed oil through 5-in. casing in 9 minutes. After a short period, production was restricted to 75 bbl. of oil a day, prorated allowable for Reynolds field wells.

Other new producer, which was likewise completed by these same operators, is about a 10-acre northwest offset to a dry hole and is 40 acres due east of another. This new producer, the 3 Long Estate, SE SW NE 12-12n-10w, Reynolds Township, Montcalm County, flowed oil to tanks through 5-in. in 20 minutes after pay was drilled between 3,329½-30½ ft.

● A sand fracturing treatment, with 30,000 lb. of sand and 15,000 gal. of fracturing oil boosted production to 60 bbl. of oil a day in the Birch Run "25" Dundee oil pool, Arbela Township, Tuscola County, at the Harry Leach 2 Murphy, SW SW SE 30-10n-7e, a new well that carried only 100 ft. of free oil natural in 24 hours from pay drilled at 2,480-95 ft. Top of Dundee was drilled at 2,460 ft. Hole was bottomed out at 2,501 ft., total depth.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Marathon Uplift Test Is Dry at 9,500 Ft.

Gulf Oil Corp.'s 1 D. S. C. Combs, a wildcat near the center of the Marathon uplift in Brewster County, southern West Texas, has stopped drilling at 9,500 ft. Operators cored extensively, from around 4,600 ft., but reported sand and shale, with occasional sand streaks, with no shows.

Location of the well is in Section 15, Block 4, GC&SF Survey, 1 mile southeast of the town of Marathon. Nearest production of any kind is about 50 miles north, near Fort Stockton in Pecos County. Puckett field, in Pecos County, is 55 miles northeast of 1 Combs.

Formation tops, if any had been determined at this time, have not been released. Possible reservoir rocks of the Marathon uplift, as listed in the book, Possible Future Petroleum Provinces of North America, are: Marathon dolomite, Simpson sandstone, and Pennsylvanian sandstone. Possible traps are anticlines, traps sealed by faults, and lenses.

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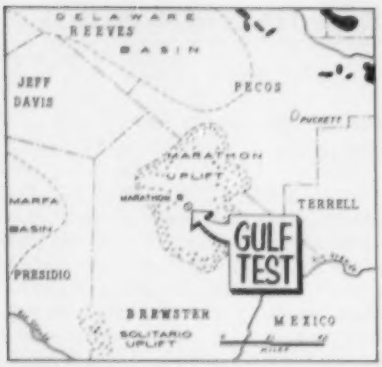

Location of Gulf's test in the Marathon uplift. Nearest production is to the north in Delaware basin fields.

Winkler County . . . TXL Oil Corp. has staked location for an 11,500-ft. Ellenburger test in northwestern Winkler County. The project will be 1 C. W. Hawkins, 24-46-T1N-T&P Survey, 17 miles northeast of Kermit and 3 miles northwest of production in TXL field in Ector County.

SOUTHEAST NEW MEXICO

Old Dry Hole Reworked, Flows Pennsylvanian Oil

Magnolia Petroleum Co. 1 Gann-Wright, SE NW 9-15s-36, north of Caudill field in Lea County, has been reworked to make a flowing Pennsylvanian discovery.

Operators perforated between 10,292-10,314 ft. and completed for 194 bbl. of 41.8° oil a day through 32/64-in. Gas-oil ratio was 930:1, flowing pressure was not reported.

Devonian extension . . . Ralph Lowe 1 Lawton-State, northeast of the same operator's 1 Wallace, Devonian discovery of Lawton field, Lea County, has been completed for 1,248 bbl. of oil a day.

Devonian perforations were from 11,956-12,012 ft. The well was gaged through 16/64-in. choke, with tubing pressure at 700 psi., and gas-oil ratio 1,481:1. Location is in SW SW 32-11s-38e.

MID-CONTINENT

OKLAHOMA

Arbuckle Pay Extended At Southeast Hoover

Arbuckle production at Southeast Hoover field has been extended across the Garvin County line from Murray County. Continental Oil Co. 1 Cox, SE SE SE 32-1n-1e, ¾ mile from the discovery well of the field (made by Frankfort Oil Co.) recovered 1,620 ft. of 40°-gravity oil from the Arbuckle at 6,390-6,540 ft.

The Cox well is on strike with Arbuckle production in 1s-1e, and is adjacent to regional fault zone just east. The two wells are probably in the same reservoir, despite minor fault areas in the immediate area.

Extension Completed At New Kingfisher Pool

An outpost to a recently-opened oil pool in Kingfisher County, north-central Oklahoma, has been completed by Big Chief Drilling Co. and Nuckolls-Bell Drilling Co. The 1 Ted Oltmanns, NE NE NW 25-18n-5w, flowed 168 bbl. of 45°-gravity oil per day on 20/64-in. choke from perforations at 5,940-60 ft. in the Oswego lime; it flowed 219 bbl. of 40°-gravity oil per day on 12/64-in. choke from open hole in the Mississippi lime at 6,219-25 ft.

The discovery well in this new field was made by Tennessee Gas Transmission Co. with production coming from lower Layton sand (oil), and gas from the Skinner sand.

HUGOTON EMBAYMENT

OKLAHOMA PANHANDLE

Morrow Well Finaled In Guymon Deep Field

Final production tests were made at 1 Joliffe Trust, a Carter Oil Co. well in NW NW SE 3-2n-18eCM, Guymon Deep field, Texas County. The well flowed 6,160 M.c.f. of gas per day on ½-in. choke from upper Morrow sand perforations at 6,264-84 ft. Calculated open flow was 14,400 M.c.f. per day.

Carter also has success indicated at its 1 Gibson Unit, NE NE SW 22-2n-19eCM. This Morrow well flowed 9,010 M.c.f. per day on tests.

SOUTHWEST KANSAS

Discovery Indicated At Comanche Wildcat

Prospects of a new gas pool in Comanche County are good as a result of tests at Gramehart-Miller 1 Kennedy "A," C NE NE 2-31s-17w, 5 miles northeast of Wilmore in the northern part of the county.

Gas was tested in both the Cherokee-Pennsylvanian and the Mississippi from perforations at 4,938-75, 4,978-95 ft.; and 4,995-5,025 ft. Location is 6 miles northwest of closest production in Robbins Ranch pool.

APPALACHIAN

WEST VIRGINIA

In Licking district, Tucker County, West Virginia, Hope Natural Gas Co. 9985 J. H. Ludwick, wildcat, elevation 1,710 ft., resulted in 12,500,000 cu. ft. gas, after fracture. Onongada 3,831 ft., Oriskany sand 3,927 ft., gas 3,961-81 ft., total depth 4,095 ft.

- Allen district, Morgan County, Trancontinental Production Co. No. 1 Amos Nestor, elevation 627 ft., shut down in the top of the Oriskany sand at 3,431 ft. to run the 5-in. casing.

PENNSYLVANIA

Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. 4092 J. G. Mailey reached the Oriskany sand at 7,420 ft., and is drilling at 7,470 ft. The Onondaga was at 7,240 ft. and the chert at 7,266 ft. The major operators are awaiting the results of this deep test.

- Brush Valley Township, Indiana County, Columbian Carbon Co., 1836 I. R. Smith is at 704 ft.

EASTERN KENTUCKY

Huntington-Oklahoma Oil Co. has a dry hole at its J. B. Wireman located on Jake Wireman Branch in Magoffin County. Test was drilled to and through the Mississippi Maxon sand to a total depth of 1,255 ft. with no showings reported.

OHIO

The Mammoth Producing 1 (2) G. W. Snow, Section 25, Killbuck Township, Holmes County, the first completed offset to the 1 C. Hoxworth, gaged 250,000 cu. ft. natural and 1,400,000 cu. ft. after fracturing second Clinton, found at 3,137-50 ft.

- Pure Oil Co. 3 F. E. Baker, 1st. Qr., Licking Township, Muskingum County, an extension to Nashport field, logged Clinton at 3,254-3,300 ft. and gaged 169 bbl. in a 24-hour test after fracturing.
- Natol's wildcat in Clark Township, Coshocton County, gaged 1,400,000 cu. ft. with 1,250 lb. rock after fracturing.

Successful Wildcats

OKLAHOMA

Hughes County: E. F. Burt 1 Morris, 1½ miles northeast of Alien in NW SE SE 3-5n-8e. IPP 35 BOPD, Senaca sand 1,128-46 ft., 31°. TD 1,150 ft. (Oil discovery).

SOUTHEAST NEW MEXICO

Eddy County: J. F. McAdams 1 Gulf-State,

36-16s-29e. IP 58 BOPD, 18/64-in., 34°, Grayburg 2,580-92 ft. TD 2,751 ft.

WEST TEXAS

Andrews County: Frank B. Waters 1 Fisher, 6-A36-PSL, 9 mi. NW Andrews. IPP 19 BOPD, GOR 325, 33°, Grayburg 4,400-4,528 ft. TD 13,404 ft.

Ector County: Coronet Oil Co. 1 Cowden, 5-42-T2N-T&P, 12 mi. NW Goldsmith. IPP 46 BOPD, 31°, GOR 824, pay 4,440-4,507 ft. TD 6,277 ft.

Pecos County: Midwest Oil Co. 1 Dickinson, 33-3-H&TC, 5 mi. SW Imperial. IP calculated 4,900 M.c.f. of gas, open flow, TP 1,775 psi., top Devonian pay 5,516 ft. TD 6,244 ft.

NORTH TEXAS

Archer County: Olin Calvin 2 Wolf, Sec. 2, SPRR Sur., A-1300, 14 mi. NW Olney. IPP 32 BOPD, 40°, GOR 200, pay 1,365 ft. TD 1,373 ft.

Baylor County: Petro Drilling Co. 1 Marak, 20-1-D&W, 1 mi. N Bomarton. IPP 20 BOPD, 35°, pay 1,526 ft. TD 1,540 ft.

Montague County: Star Oil Co. 1-B Chandler, Thos. Green Sur., A-303, 5 mi. W Belcherville. IP 182 BOPD, ¼-in., CP 600 psi., GOR 675, 42°, Caddo lime 5,524-34 ft.; IP 143 BOPD, 16/64-in., TP 815 psi., GOR 740, 39°, Caddo conglomerate 5,559-77 ft. TD 5,730 ft. Dual completion, new field name, Milan, East.

W. T. Waggoner estate 1 Carminati, L. J. Vaden Sur., A-828, 2 mi. N Montague. Originally completed at 5,982-96 ft., recompleted as Strawn discovery. IPP 119 BOPD, 40°, GOR 278, perforations 4,942-52 ft.

Wise County: Christie, Mitchell & Mitchell 1 Katie Moore, J. H. Tadlock Sur., A-1031, 6 mi. SW Chico, Strawn discovery in Morris conglomerate field. IPP 45.5 BOPD, 41°, GOR zero, pay 4,298-4,316 ft. TD 5,754 ft.

WEST VIRGINIA

Tucker County: Licking district: Hope Natural Gas Co. 9985 J. H. Ludwick, elevation 1,710 ft., 12,500,000 cu. ft. gas after fracture, chert 3,831 ft., Oriskany sand 3,927 ft., gas 3,961-81 ft. TD 4,095 ft.

SOUTH LOUISIANA

Lafayette Parish: J. P. Owen et al 1 Clement, 11-10s-2e. Shut-in gas-condensate well, no gage, perforated 11,798-11,818 ft. TD 13,405 ft. (New filed—3 miles west of Duson field).

St. Martin Parish: The California Co. 1 State Lease 2162, Lake Palourde, 22-15s-13e. IP 51 BCPD and 1,725 M.c.f. daily, 9/64-in., 61.8°, perforations 14,088-14,105 ft. TD 14,982 ft. (New field—2½ miles northwest of East Lake Palourde field).

Kerr-McGee Oil Industries, Inc., 1-B Schwing, 3-11s-9s. IP 356 BOPD, 5/32-in., 45.5°, perforations 12,870-85 ft. TD 13,665 ft. (New field—1¾ miles southwest Bay Chene field).

MISSISSIPPI

Wilkinson County: J. M. Harper, Jr., 1 Berry et al, 23-1n-4w. IP 116 BOPD, 3/32-in., 35.7°, perforations 8,222-28 ft. (Wilcox-McKittrick sand). TD 9,021 ft. Elev. 76 ft. Wilcox 6,416 ft. (New field—Fort Adams).

GULF COAST

Bee County: Atlantic Refining Co., 1 Rabe, J. M. Uranga Sur., A-68. IP 53,000 M.c.f. daily, open-flow potential, GOR 15.3 M.c.f. per bbl. 53.7°, perforations 8,920-54 ft. and 8,958-68 ft. (Wilcox). TD 9,988 ft. (New pay in Normanna field).

Harris County: Claud B. Hamill 1 Benignus, John Jones Sur., A-481. IP 121.7 BOPD, 3/16-in., 37.5°, perforations 5,872-80 ft. (Cockfield). TD 5,980 ft. (1 mile west of Kuhlman field and ¾ mile east of Rotherwood field).

Live Oak County: Melba Production Co. 2 Julius Wright, M. B. Kivlin Sur., A-21. IP 5,100 M.c.f. daily, open flow, GOR 51.8 M.c.f. per bbl., 66°, perforations 4-262-69 ft. TD 5,001 ft. (New field—well previously completed in October 1955 as dry hole with Ussery Drilling Co. as operator.)

SOUTHWEST TEXAS

Atascosa County: British Texas Oils 1 Byrd, Sec. 13, T. R. Witten Sur., A-1076. IP 225.54 BOPD, ½-in., 22.5°, open hole 6,330-6,440 ft. (Austin chalk). TD 6,440 ft. (New field).

KANSAS

Barber County: Northwest Sharon pool discovery. Pickrell Drilling Co. 1 Slinker, NW NW NW 11-32s-10w. Completing in Mississippi. TD 4,470 ft.

Cowley County: Northwest Biddle pool discovery. O. A. Sutton 1 Morris, NE NW SE 1-32s-4e. Completing in Bartlesville sand. TD 3,060 ft.

Decatur County: Van Fleet pool discovery. Cities Service Oil Co. 1 Van Fleet, NW NE NW 9-1s-27w. IP 31 BOPD, Lansing. TD 3,611 ft.

Kearney County: South Side pool discovery. Helmerich & Payne 4 White "O," NE SW NW 13-26s-35w. Completing in Morrow. TD 5,227 ft.

Kingman County: Goetz pool discovery. Pryor

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& Tracy 1 Goetz, NW NW SW 29-29s-9w. IP 24,000 M.c.f. of gas per day, Viola. TD 4,606 ft.

Kiowa County: Hardy pool discovery. Kewanee Oil Co. 1 Hardy, NE NW NE 23-28s-18w. IP 540 M.c.f. of gas per day, Mississippi. TD 5,260 ft.

Ness County: Ryersee pool discovery. Stickle Drilling Co. 1 Ryersee, C NW SE 35-18s-21w. IP 198 BOPD, Cherokee. TD 4,230 ft.

Schoharie pool discovery. Anschutz-Kan-Tex 1 Cooper, SE SE SE 22-19s-23w. IP 72 BOPD, Fort Scott. TD 4,840 ft.

Pawnee County: South Jay pool discovery. Stickle 1 Smith, NE NE SW 9-23s-15w. Completing. TD 4,190 ft.

Pratt County: Haskins pool discovery. K&E Drilling Co. 1 Haskins. NE NW NE 5-27s-14w. Completing. TD 4,620 ft.

Rooks County: South Annon pool discovery. Oil Trading Corp. 2 Briggs, SE NE NW 34-10s-20w. Completing. TD 3,715 ft.

North Gra-Rock pool discovery. K&E Drilling Co. 2 Towns Estate, SW NW NE 18-9s-20w. Completing in Arbuckle. TD 3,760 ft.

Sheridan County: Advance pool discovery. Heathman-Seeligson Oil Co. 1 Brown "A," NW NW NW 26-8s-27w. Completing in Lansing. TD 4,528 ft.

Stafford County: North Harter pool discovery. Natural Gas & Oil Corp. 1 Dudrey, NE SW SE 19-24s-13w. Completing in Lansing. TD 4,231 ft.

Northwest Seevers pool. McKnab Drilling Co. 1 Goodman, NE SE NW 6-25s-13w. Completing in Arbuckle. TD 4,196 ft.

OKLAHOMA

Harper County: Sunray Mid-Continent Oil Co. 1 Barby "A," 6½ miles northwest of new field in C SE NW 1-26n-26w. IP 550 M.c.f. of gas per day, Hoover sand 4,195-4,282 ft., 24/64-in. choke. TD 5,502 ft. (Gas discovery in Laverne district of Hugoton embayment).

Sunray 1 Barby, C SE SE 12-26n-26w. Calculated open flow potential: 9,000 M.c.f. of gas per day, Hoover sand 4,112-48 ft. TD 4,405 ft. (Gas discovery in Laverne district of Hugoton embayment).

COLORADO

Larimer County: J. G. Dyer 1 W. R. Saulcy, C NW SE 32-5n-68w. IPP 15 BOPD, Dakota discovery, new field. TD 6,911 ft. Lyons sand.

Logan County: Denver Basin Petroleum Co. 1 Ostermiller, NE NE NE 36-6n-54w. IPP 120 BOPD, "J" sand discovery, new field. TD 4,755 ft. J sand.

NEBRASKA

Roy G. Woods 1 McCord, C SW SW 19-17n-43w. IPP 80 BOPD, 15 BWPD, "D" sand discovery, new field. TD 3,450 ft. Morrison.

Kimball County: Strain Drilling Co. and Petroleum, Inc., 1 State, C SW NE 16-15n-55w. IPP 110 BO 24 hours, "J" sand discovery, new field. TD 6,350 ft. Skull Creek.

ALBERTA

Texaco-McColl B-6-8 Braemar, LSD 6, 8-50-10w5. TD 5,550 ft., Cardium oil well.

SASKATCHEWAN

Mobil Woodley Southern 15-8 Webb, LSD 8, 15-15-17w3. TD 3,951 ft. Roseray oil well.

Sun A. Breeze 13-7, LSD 13, 7-5-5w2. TD 4,700 ft. Mississippian oil well.

CALIFORNIA

Santa Barbara County: Getty Oil Co. 32 Los Alamos, NW SE 6-8n-32w, 308 BOPD, 13.5° gravity, perfs. 2,740-60 ft., 2,812-28 ft., 3,093-3,107 ft. TD 5,210 ft. (New pool discovery approximately 2,000 ft. east of the south limits of West Cat Canyon area).

Orange County: Patrick A. Doheny 1 Stern, SW NE 35-3s-9w, 81 BOPD, 16° gravity, perfs. 3,140-86 ft. TD 3,300 ft. (New pool discovery in Kraemer field).

ALBERTA

Hudson's Bay 1 Gilby West, LSD 12, 8-41-3w5. TD 7,150 ft. Viking oil well.

NEBRASKA

Kimball County: Bass, Vessels & Brown 1 Griffith, E½ NW NE 10-15n-55w. IPP 134 BOPD, "J" sand discovery, new field. TD 6,238 ft. "J" sand.

Frontier Refining Co. 2 Burdick, C NW NW 24-16n-58w. IPP 125 BOPD, "J" sand discovery, new field. TD 7,173 ft. "J" sand.

WYOMING

Natrona County: Richfield Oil Corp. 1 Northern Utilities, E½ SW SE 10-35n-85w. IP 1,450 M.c.f. of gas per day, Frontier discovery, new pay. TD 7,185 ft.

TEXAS PANHANDLE

Ochiltree County: R. H. Fulton 1 Barber "15," 3 miles southwest of Farnsworth in west-central part of county, 3½ miles northwest of Farnsworth field in Sec. 15, Blk. 4-T, T&NO Sur. IPF 621 BOPD, ¼-in. choke, Morro sand 7,608-29 ft. 37°, GOR 1,875:1. TD 8,500 ft. (New oil discovery in Hugoton embayment).

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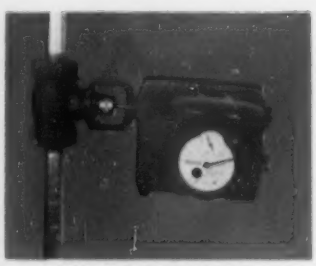

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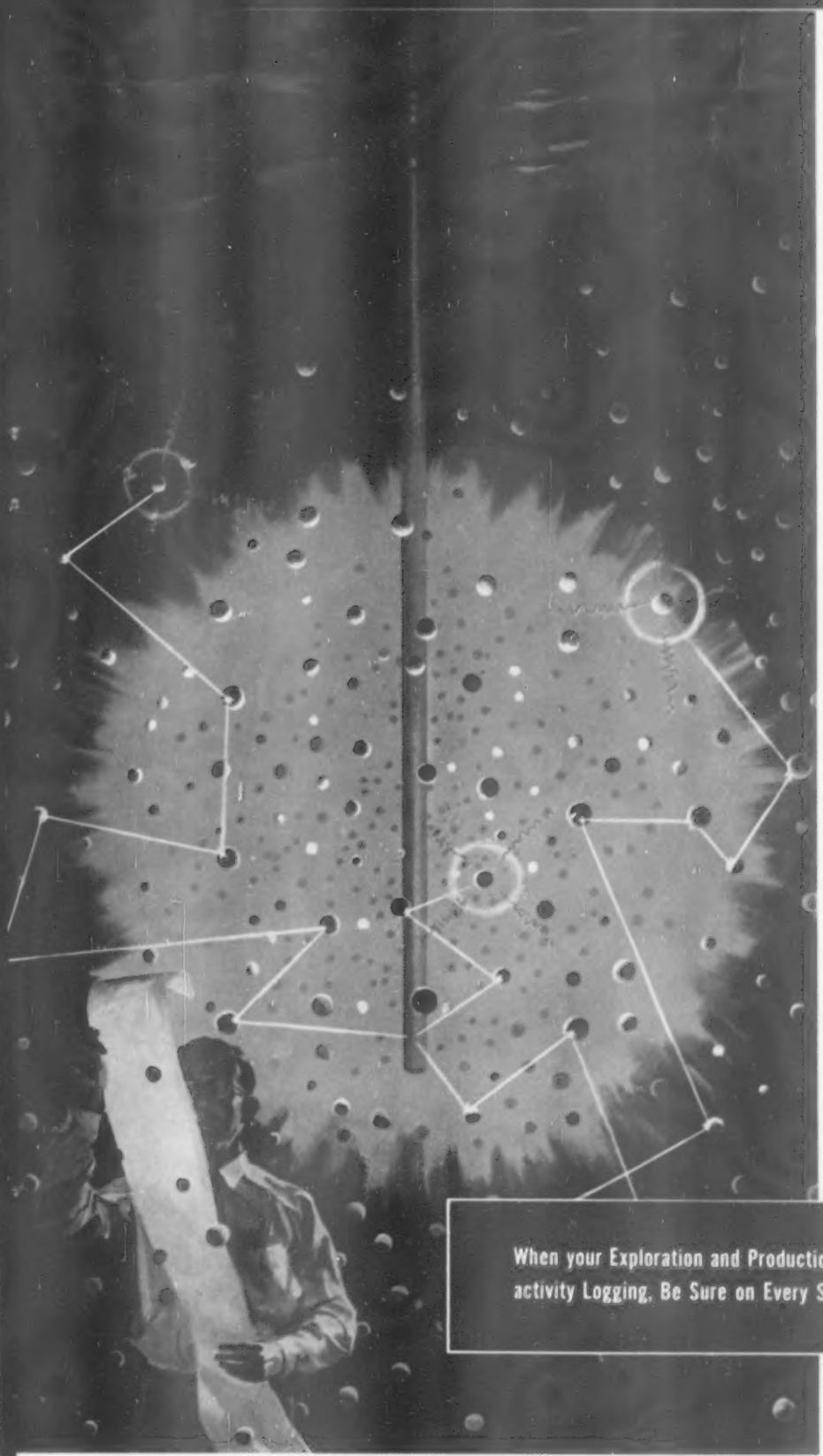

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Imperial's Dr. Stratford . . .

. . . Explorer in Many Fields

WHETHER he is an oil finder, researcher, or laborer, "to be truly creative, a man must explore many fields," says Dr. R. K. Stratford, scientific advisor to Imperial Oil, Ltd.

Dr. Stratford's own career underscores the value of this philosophy. Agriculturist and chemist by training, he also has been a theatrical director, music lover, horticulturist, and teacher.

Recent honors which have come his way also prove Dr. Stratford has not neglected his main work—keeping Imperial in the front-running with new technical developments.

When Reginald Killmaster Stratford joined the staff of Imperial's Sarnia Ont., refinery in the summer of 1924, nobody was impressed. The 29-year-old chemist had only academic background—no industrial experience.

A long way . . . What his colleagues didn't know was Stratford had come a long way in 29 years through perseverance.

He had fought back the pain of a bone disease in one leg, pulled himself out of bed, and learned to hobble around on crutches. Later he graduated to a cane and went in for boxing, golf, dancing, ice boating, sailing, chicken raising, and flower gardening. While an invalid, he had read widely in classic literature and was tutored through high school classes by an older sister and a patient cousin.

Later he earned a bachelor's degree in scientific agriculture at Ontario Agricultural College, Guelph, Ont., and a master of science degree at Amherst, Mass. He put in 4 years of agricultural work for the Ontario government, spent a year in post-graduate study in chemistry at Guelph and lectured a year there.

Work for nothing . . . Stratford left Guelph to study for a doctorate in chemistry at the University of Lyons, France. When he had worked patiently for 7 months doing research for his thesis, he discovered the university library contained a thesis almost identical with the one he planned. He threw aside all his work and started over from scratch on another subject, working through the summer vacation to finish on time.

The bad luck of the thesis incident may have been a good omen. The topic of the finished thesis was catalytic cracking and pure hydrocarbons—now an important process in petroleum refining.

Stratford wanted to teach after leaving Lyons but couldn't find a desirable university post. He decided to try for an industrial job and because of his thesis sought an oil company which brought him to Imperial.

Busy progress . . . When Stratford joined Imperial he became a one-man chemical research bureau.

Twenty-seven years later he was appointed the company's scientific advisor. But in the interim he had expanded his work into an 83-member technical and research department, patented some 30 petroleum products and processes, and supervised development of countless others. Fourteen processes devised in his laboratory have been rated major industrial achievements. One of them, conceived in the 1920's, revolutionized the manufacture of lubricating oils.

Stratford has had two broad policies in recruiting his staff: Attract researchers from all over the world and instill in them his own attitude toward creative research. He believes a scientist can develop his creative faculties to their fullest only if he exercises them in as many worth-while fields as time will allow.

He says "the scientist is often not systematic . . . When a scientist deals with the unknown, discovery becomes a matter of imagination and intuition rather than a slow, patient buildup of recognized facts."

Plenty of openings . . . So Stratford made sure his staff had plenty of opportunity to cultivate other arts.

The way he recruited actors and stage hands for the Sarnia Drama League was a standing joke around the lab for years. He has won renown as a flower grower and horticulturist. He's famous for the way he raises flowers all year round on 7-acre riverside home south of Sarnia. He also has a large collection of classical records and still is a great reader. Besides all this Stratford has a warm personality. He is a great conversationalist and good listener.

Stratford was among a handful of men who succeeded in forming the Chemical Institute of Canada from three rival groups of chemists. At various times both in peace and war he has served on several professional and industrial organizations. He also has received honorary degrees from two colleges and awards from both the Chemical Institute of Canada and the Canadian section of the Society of Chemical Industry.

Robert L. Kidd has succeeded the late Singer B. Irelan as president of Cities Service Oil Co. In accepting the new post, Kidd resigned as president of another Cities Service Co. subsidiary, Arkansas Fuel Oil Corp., Shreveport. He has been succeeded in that position by **J. E. Heston** of Bartlesville, Okla., who resigned as vice president of Cities Service Oil. Kidd joined the Cities Service system in 1925 as a geologist. He served as vice president for oil and gas production and exploration of Cities Service Oil and in 1953 was elected president of Arkansas Fuel Oil, as well as president of two subsidiaries of that company, Arkansas Pipeline Co. and Orange State Oil Co. Heston joined Cities Service in 1930. He became manager of the oil production department of Cities Service Petroleum, Inc., in 1951 and transferred to Bartlesville as vice president and director of Cities Service Oil in 1954.

R. L. KIDD

J. E. HESTON

Stuart F. Silloway has been named president of Pacific Northwest Pipeline Corp., Houston, succeeding **C. R. Williams,** who is now vice chairman of the board of directors. Silloway, former vice president for finance of Mutual Life Insurance Co. of New York, will

Personals

direct operations of both the pipeline firm and the subsidiary, Northwest Production Corp. He will headquarter in Salt Lake City where Pacific Northwest is establishing its principal office.

Roy A. Doman, chief civil engineer for New York State Natural Gas Corp. since 1951, has been named chief engineer for the company.

R. George Murray, Jr., executive vice president of Dutton - Williams Brothers, Ltd., Calgary, has been elected a director of the firm. Murray joined Dutton-Williams in 1955 and was previously with Algonquin Gas Transmission Co., Boston, as operating vice president.

Kingsley V. (King) Schroeder of Beaumont, Tex., has been named director of production for Sun Oil Co., succeeding **Robert W. Pack,** who is retiring. Schroeder was formerly assistant division manager of Sun's Gulf Coast production division in Beaumont. He will be succeeded there by **L. Millard Moor,** who has been administrative assistant to the division manager. Schroeder joined Sun in 1933 and transferred to the Gulf Coast division 3 years later. He became chief geologist for the division in 1947, added the duties of manager of the land department in 1951, and was made assistant division manager in 1954.

S. W. THOMSON

Stuart W. Thomson has been appointed assistant manager of the Paulsboro, N. J., refinery of Socony Mobil Oil Co., Inc. Thomson joined Socony Mobil in 1937 as a student engineer. He has held a number of supervisory posts at the Paulsboro plant. Additional appointments at Paulsboro include **R. C. Hartman,** as assistant to the manager; **H. D. Chapman,** as operating superintendent; **E. D. Keiper,** as assistant superintendent of the lube-wax division; and **Elmer L. Smith,** as assistant superintendent of the light products division.

J. A. Hord, formerly division exploration geologist for Gulf Oil Corp. in Fort Worth, has been appointed to the newly created position of division production geologist. **F. O. Mortlock** succeeds Hord as division exploration geologist. Transferred to the Fort Worth production department are **J. A. Norwood,** formerly zone production geologist, Midland; **L. L. Fuller,** zone production geologist, Roswell, N. M.; **M. A. Gebel,** senior staff production geologist, Wichita Falls, Tex.; and **E. J. Webb,** special staff production geologist, Amarillo, Tex.

Geologists Start Early to Plan 1957 Meeting

This is the central committee in charge of all arrangements for the forty-second annual meeting of the American Association of Petroleum Geologists and the thirty-first annual meeting of the Society of Economic Paleontologists and Mineralogists. The joint meeting will be held April 1-4 next year in St. Louis. From the left are E. W. Ellsworth, A.A.P.G. business manager; P. E. Fitzgerald, Dowell Incorporated; Daniel A. Busch, consultant; Thomas E. Matson, consultant; H. T. Morley, Stanolind Oil & Gas Co.; and Robert H. Dott, A.A.P.G. executive director. Not shown is Parke A. Dickey, Carter Oil Co., also a member of the central committee. The photo was made in Tulsa at the first planning session of the group.

Fordyce Hauber, system reserves engineer for New York State Natural Gas Corp., Pittsburgh, has assumed additional duties as executive assistant.

Gordon E. Jacober has been appointed exploration manager of Texas Pacific Coal & Oil Co.'s Rocky Mountain division in Denver. Jacober previously spent 8 years with Sun Oil Co., Husky Oil & Refining Co., and Standard Oil Co. of California as geologist in the Rocky Mountain area.

Edwin J. Barth, refining consultant of Northampton, Mass., has accepted the position of chief chemist at the Iraqi Government's lubricating and asphalt refinery in Baghdad.

Charlie Bryce has become drilling superintendent and assistant to the president of B. L. McFarland, Inc., of Midland. He formerly served as vice president of Delaware Drillers, San Angelo, Tex.

Robert W. Sanders has been appointed supervisor of chemical operations at The Texas Co.'s Lockport, Ill., refinery. **William H. Roach** has been named chief chemist at Texaco's Eagle Point refinery, Westville, N. J. Sanders joined The Texas Co. in 1932 and was chief chemist at the Eagle Point plant until his appointment to Lockport. Roach has been on loan from Texaco since 1954 to Iranian Oil Refining Co., N. V. Prior to that, he was chief chemist at Texaco's Lawrenceville, Ill., plant.

M. E. HOUSER, JR.

C. H. BARRE

M. E. Houser, Jr., chief process engineer for Republic Oil Refining Co., Texas City, Tex., has been promoted to superintendent. He succeeds **D. B. Smith,** who has resigned to enter business as part owner of Refinery Construction Co., Houston, and Buenos Aires, Argentina. **C. H. Barré,** associated with Republic since 1946, has been named coordinator of manufacturing at Texas City.

C. D. Mims has been elected a director and has been made vice president in charge of production of Standard Oil Co. of Texas, a subsidiary of Standard Oil Co. of California. He was formerly vice president in charge of production for California Standard Co., Cana-

dian subsidiary of Standard of California. He has been succeeded there by **L. A. Swanson,** formerly chief engineer for Standard of Texas. Mims joined Standard of Texas in 1946 as a petroleum engineer. He was field foreman during development in 1949 of the Kelly-Snyder field in Texas, and was then appointed manager of production for California Standard. He became vice president in charge of production in 1952.

J. G. Lillard has been made senior chemical engineer at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **D. E. Nicholson** has become senior research chemist in the research and development division of the plant; **F. M. Orr,** technical specialist in the technical service division; and **Clinton W. Bates,** supervising engineer in the engineering division.

R. E. Wright has been appointed staff petroleum engineer in the domestic producing department of The Texas Co. with headquarters in New York. He has been petroleum engineer in the company's general manager's office in Houston since 1955.

W. C. Summy, formerly assistant division production superintendent for Sinclair Oil & Gas Co. in Houston, has been transferred to Sinclair Oil & Refining Co. in Venezuela as superintendent of the company's Santa Barbara operations.

L. I. BYARS

L. I. Byars, formerly in charge of gas purchases and sales for Skelly Oil Co.'s gasoline plants, has become manager of the company's newly formed gas division in Tulsa. He will be responsible for gas sales from Skelly leases and purchases and sales from gasoline plants. **Edward H. Moores** has been transferred from the legal department to the new gas division as assistant to Byars.

George Sawtelle, president of Kirby Oil & Gas Co., Houston, was recently awarded the honorary degree of doctor of science by Marietta College, Ohio. Sawtelle also received last month the highest honor bestowed by Lehigh University's alumni association for his "imposing career in the petroleum industry."

Edward L. Shea has been elected chairman of the board of Ethyl Corp. He is succeeded as president by **B. Bynum Turner,** formerly executive vice president. Shea will continue as chief executive of the company.

Monroe E. Spaght, executive vice president and director of Shell Oil Co., New York, has been elected honorary chairman of the American Section, Society of Chemical Industry, for the year 1956-57.

WHELESS, JR.

R. V. PIERCE

N. Hobson Wheless, formerly president of Wheless Drilling Co., Shreveport, has become chairman of board and **Nicholas H. Wheless, Jr.,** formerly vice president, has succeeded him as president. **R. V. Pierce,** head of Gulf Coast operations for Wheless with headquarters at Houma, La., has become vice president. The younger Wheless joined the company in 1938 upon graduation from Massachusetts Institute of Technology. Pierce became associated with Wheless in 1943 and has been in charge of Gulf Coast operations since that time. He will continue to headquarter at Houma.

Kenneth W. Davis, Jr., president of Unit Rig and Equipment Co., Tulsa, has been named executive vice president of Loffland Brothers Co. He will be succeeded as president of Unit Rig by **J. L. Vint, Jr.**

E. D. McElvain, Phillips Petroleum Co., formerly director of the natural gas department's industrial development division in Bartlesville, Okla., has been promoted to manager of Phillips' Washington, D. C., office. He succeeds **R. C. Jopling,** vice president, who has retired. **C. D. Whitfield,** assistant to Jopling in Washington, has been transferred to Bartlesville to replace McElvain as director of the natural gas department.

Personals

Paul D. Balbin, head of Stanolind Oil & Gas Co.'s geophysical operations in the North Texas-New Mexico division in Fort Worth, has resigned to open offices as a consultant. He was associated with Stanolind for 20 years.

Howard L. Cromwell has been appointed plant manager of Stauffer Chemical Co.'s Freeport, Tex., operations, succeeding **Richard Owen,** who is now production manager of the eastern agricultural chemicals division.

Harold G. Osborn, vice president in charge of manufacturing for Continental Oil Co., Ponca City, Okla., and **A. W. Tarkington,** vice president and regional general manager, Fort Worth, have been made senior vice presidents of the company and moved to Houston.

William H. Flood, Jr., has been appointed to the newly created position of production manager of Northern Natural Gas Producing Co., Omaha. Flood comes to Northern after 12 years with Republic Natural Gas Co. He has been district superintendent at Republic's Guymon-Hugoton district at Hugoton, Kans., for the past 10 years.

Philip M. Cordell, Jr., has been named coordinator and economist for Texas Gas Corp., Houston.

DEATHS

Walter L. Ives, 64, independent operator of Tulsa, died July 2 at Siloam Springs, Ark., after suffering a heart attack.

John Grimke Browder, 48, research chemist for Humble Oil & Refining Co., died June 27 in Houston. He had been a research chemist at Humble's Baytown refinery 27 years.

Wilson (Cotton) Metcalf, 51, formerly chief scout and more recently representative of the crude-oil purchases and sales division of The Texas Co., died July 1 in Tulsa after a brief illness.

Walter Earl Crone, 46, drilling superintendent for Harrell Drilling Co., Houston, died there June 26.

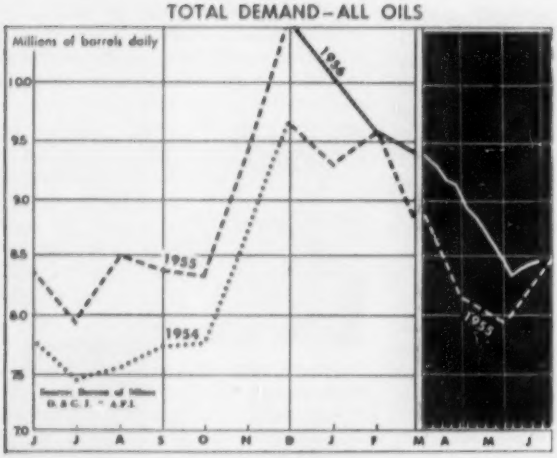
R. B. (Reid) Grainger, veteran representative for Byron Jackson Tools, Inc., died recently in Ojai, Calif.

Oral W. Johnson, 72, technician with Standard Oil Co. of California, died recently in Los Angeles.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,047,750	DOWN	15,450	UP	134,853
Crude stocks	275,631,000	UP	1,556,000	UP	2,226,000
Completions	1,118	DOWN	105	DOWN	5
Refinery runs	8,144,000	UP	57,000	UP	645,000
Gasoline stocks	181,601,000	UP	497,000	UP	21,990,000
Kerosine stocks	25,779,000	UP	1,196,000	DOWN	4,120,000
Distillate stocks	93,672,000	UP	5,879,000	DOWN	6,309,000
Residual stocks	38,374,000	UP	324,000	DOWN	6,425,000
Four-product stocks	339,426,000	UP	7,896,000	UP	5,136,000
Total imports	1,246,400	DOWN	404,800	UP	414,900



Second-Quarter Gasoline Stock Cuts Were Normal But Not Enough

GASOLINE stocks have had a near-normal decrease in the second quarter of this year. The trouble may have started as early as 1952, reaching a climax at the end of the first quarter of this year when finished and unfinished gasoline inventories reached almost 200,000,000 bbl.

The history of gasoline stocks since the refinery strike in 1952 shows periods of rapid additions to inventories, followed by soft markets and months of reduced production.

Here is a short running account of the ups and downs of gasoline stocks since the first quarter of 1952. At the end of March 1952, total gasoline in primary storage represented an increase of 7.3 per cent over the corresponding date in 1951. The average for the postwar period has been about 6.25 per cent.

The refinery strike in May 1952 reduced production of gasoline and made it necessary to draw on inventories to the extent of 28,200,000 bbl. Since this represented about a full summer's reduction in stocks, refiners had to meet late-summer demand through increased refinery production of gasoline. Stocks were reduced only 2,700,000 bbl. between the first of June and the end of September.

The same type of operation was carried over into the summer of 1953 when the stock drop for July, August, and September amounted to less than 3,000,000 bbl. Rapid buildup of stocks in the last quarter of 1953 and the first quarter of 1954 resulted in a stock level at the end of the first quarter of 1954 that was 12.4 per cent above the total for the end of March 1953. The effect on markets is shown by the drop of at least a cent a gallon in spot prices between late summer 1953 to the same period in 1954.

Lower prices produced cuts in refinery production of gasoline, enough to bring stocks at the end of 1954 below the level reported for the close of 1953.

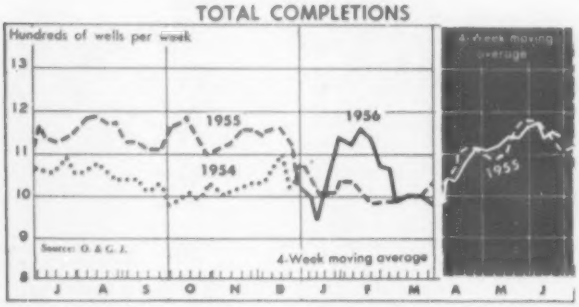
With this better condition at the start of 1955, gasoline stocks for the first 9 months of the year remained below previous year except for closing stocks for February and March. The condition did not indicate low inventories in 1955; just that stocks in 1954 had been too high.

Since most of the correction in 1954 came in the last quarter of the year, near-normal operations in the last quarter of 1955 put enough gasoline in storage to bring year-end stocks 6.5 per cent above inventories at the end of 1954. First-quarter addition to stocks was at a higher rate in 1956 than in 1955 so that stocks at the end of March were up 8.5 per cent from previous year compared with the 6.5 per cent increment at the first of the year.

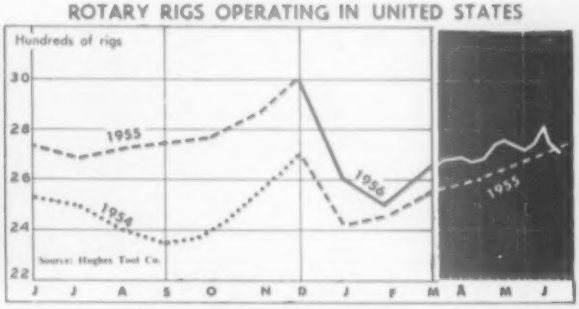
Current figures indicate that gasoline stocks dropped almost 12 per cent during the second quarter of this year. The second-quarter average for the postwar period has been about 11.7 per cent, excluding the abnormal second quarter of 1952.

Gasoline markets for the remainder of the summer may be determined by activities in the first half of July. A stock drop of 5,000,000 bbl. during the first 2 weeks of the month would help the market, but this may be too much to expect since the industry never has had a reduction of 10,000,000 bbl. in gasoline stocks for the full month of July.

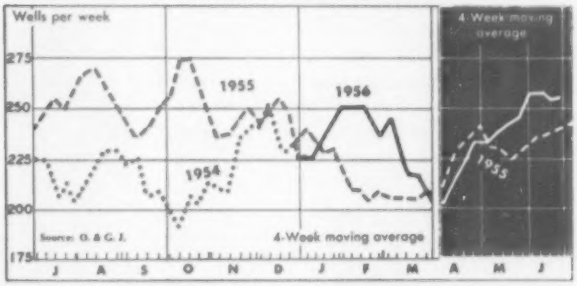
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	7-2-56	6-25-56	7-4-55
North Central and East	140	130	145
Southeast	29	30	25
Okla., Kans., Ark., Mo.	483	506	530
Louisiana	445	448	397
North and East Texas-Panhandle	413	426	402
Gulf and South Texas	259	272	259
West Texas-New Mexico	536	545	533
Rocky Mountain	277	262	291
Pacific Coast	126	123	151
Total United States	2,708	2,742	2,733
Western Canada	235	252	204

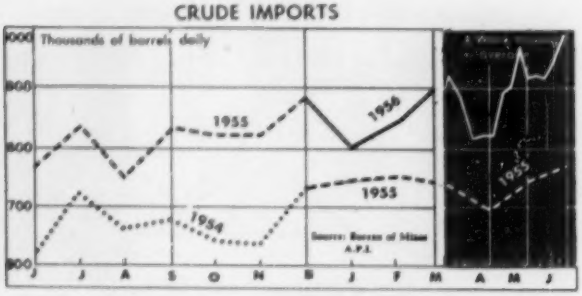
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 30, 1956

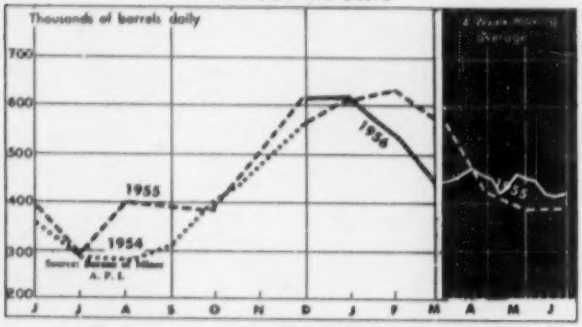
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	4	2	0	2	31,424	52	44	0	0	0	2	2	0	0	1	24	25
Arkansas	11	6	0	5	43,076	386	364	0	0	0	3	3	19	0	3	65	87
California	46	33	1	12	204,352	1,086	1,314	0	0	0	11	11	21	0	3	209	233
Colorado	25	5	2	18	126,986	585	671	0	0	0	12	12	16	0	6	256	278
Illinois	107	41	7	59	243,685	1,805	1,837	0	0	0	21	21	27	0	0	312	339
Indiana	8	3	0	5	15,554	305	380	0	0	0	1	1	9	0	1	57	67
Kansas	99	35	6	58	338,383	2,537	2,550	3	0	0	23	26	64	2	13	459	538
Kentucky	49	20	5	24	67,490	838	630	2	0	0	6	8	25	0	1	175	201
Louisiana	59	33	10	16	404,356	1,935	1,969	2	0	2	5	9	58	31	30	250	369
North	29	15	6	8	103,464	791	1,036	1	0	0	1	2	16	1	1	95	113
South	27	16	3	8	276,353	922	933	1	0	2	4	7	33	27	21	139	220
Offshore	3	2	1	0	24,539	222		0	0	0	0	0	9	3	8	16	36
Michigan	11	6	1	4	32,755	229	255	0	0	0	2	2	5	0	0	73	78
Mississippi	7	3	0	4	50,643	218	241	1	0	0	4	5	9	1	1	85	96
Montana	8	2	0	6	31,108	175	151	0	0	0	6	6	8	0	0	47	55
Nebraska	25	9	0	16	145,342	524	345	2	0	0	10	12	22	0	0	235	257
New Mexico	33	17	14	2	146,545	915	757	1	0	0	2	3	26	0	6	81	113
Northwest	17	3	12	2	78,586	350	212	0	0	0	2	2	2	0	5	24	31
Southeast	16	14	2	0	67,959	565	545	1	0	0	0	1	24	0	1	57	82
North Dakota	7	4	0	3	66,132	119	108	0	0	0	1	1	7	0	0	24	31
Ohio	27	6	7	*14	59,718	520	535	0	0	0	0	0	0	0	1	4	5
Oklahoma	122	77	8	*37	420,938	4,319	4,271	1	0	2	9	12	65	15	25	362	467
Pennsylvania-New York	2	0	1	1	7,093	514	610	0	0	0	1	0	0	0	4	3	7
Texas	413	243	18	152	1,677,784	10,960	9,959	19	1	7	82	109	382	18	97	2,350	2,847
Southwest (1 & 4)	70	35	10	25	274,787	1,620	1,556	4	0	5	12	21	73	5	36	434	548
Gulf Coast (2 & 3)	46	18	1	27	315,472	1,339	1,282	2	1	1	15	19	36	9	35	352	432
East (5 & 6)	22	7	2	13	99,827	564	489	0	0	0	5	5	8	1	5	204	218
N. Central (7-B & 9)	165	94	1	70	468,672	3,960	3,665	10	0	0	33	43	165	0	3	936	1,104
West (7-C & 8)	96	80	1	15	450,782	2,850	2,486	2	0	1	15	18	91	0	9	393	493
Panhandle (10)	14	9	3	2	68,244	627	481	1	0	0	2	3	9	3	9	31	52
Utah	23	2	1	20	83,080	64	37	0	0	0	16	16	1	0	2	37	40
West Virginia	19	2	16	1	47,110	328	297	0	0	1	0	1	0	0	6	6	12
Wyoming	13	8	1	4	64,345	376	370	0	0	1	2	3	8	0	6	93	107
Miscellaneous	0	0	0	0	0	58	19	0	0	0	0	0	4	0	0	46	50
Total U. S.	1,118	557	98	463	4,307,899	†28,848	27,696	31	1	13	218	263	776	67	206	5,253	6,302
Total previous week	1,223	714	74	435	4,915,410			24	3	7	207	241	739	69	191	5,035	6,034
Total July 2, 1955	1,123	615	74	434	4,336,927			37	4	3	197	241	781	107	180	4,797	5,865
Cumulative 1956	28,848	15,809	1,910	11,129	117,107,630												
Western Canada	78	62	4	12	364,837	1,232											

Service wells included: *3. †All figures actual except Ohio, Ky., and Canada.

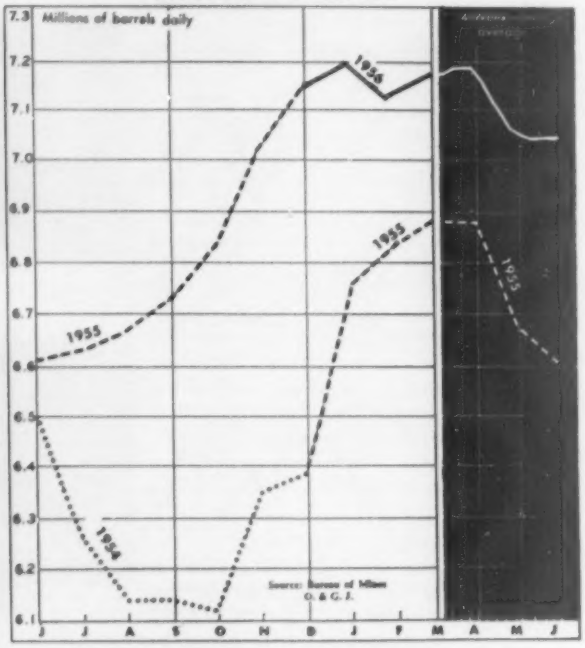
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

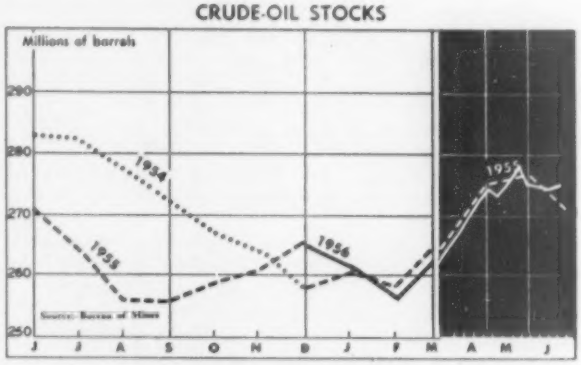


DAILY AVERAGE PRODUCTION FOR WEEK

	June 30, 1956			June 23
	Crude oil	Lease condensate	Total	total
Alabama	6,600		6,600	5,200
Arkansas	75,000	400	75,400	75,150
California	964,500		964,500	965,600
Colorado	165,500		165,500	168,000
Eastern	50,300		50,300	50,100
Florida	1,350		1,350	1,350
Illinois	227,800		227,800	226,800
Indiana	31,800		31,800	31,300
Kansas	343,200		343,200	343,800
Kentucky	47,400		47,400	47,700
Louisiana	725,300	60,300	785,600	785,100
North	121,300	2,300	123,600	123,100
South	604,000	58,000	662,000	662,000
Michigan	29,400		29,400	29,600
Mississippi	106,800	4,250	111,050	111,050
Montana	61,900		61,900	59,200
Nebraska	37,200		37,200	40,700
New Mexico	236,200	4,600	240,800	240,200
North Dakota	32,400		32,400	32,900
Oklahoma	584,400		584,400	599,800
Texas	2,908,000	48,450	2,956,450	2,956,450
Dist. 1	54,000	425	54,425	54,425
Dist. 2	145,000	8,025	153,025	153,025
Dist. 3	428,000	22,625	450,625	450,625
Dist. 4	231,000	5,350	236,350	236,350
Dist. 5	44,000	425	44,425	44,425
Dist. 6	120,000	5,500	125,500	125,500
East Texas Field	204,000		204,000	204,000
Dist. 7-B	153,000	50	153,050	153,050
Dist. 7-C	184,000	3,800	187,800	187,800
Dist. 8	1,034,000	1,700	1,035,700	1,035,700
Dist. 9	216,000	400	216,400	216,400
Dist. 10	95,000	150	95,150	95,150
Utah	5,000		5,000	5,200
Wyoming	289,400		289,400	287,800
Others	‡300		‡300	200
Total U. S.	6,929,750	118,000	**7,047,750**	7,063,200
Change from previous wk., down			**15,450**	
Canada	†463,800		†463,800	†427,100
Total U. S. production January 1-June 30			1,275,669,856 bbl.	
Same period last year (crude plus cond.)			*1,226,335,606 bbl.	

*Includes 20,382,975 bbl. condensate. †Week ended previous Monday. ‡Nev.

CRUDE-OIL STOCKS



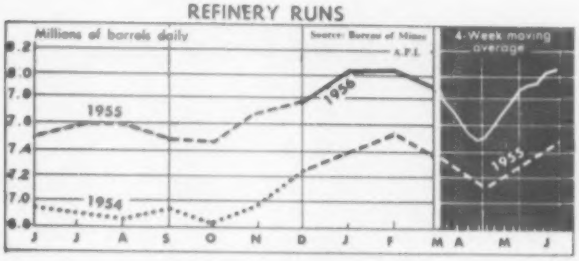
CRUDE-OIL STOCKS BY STATES OR ORIGIN*

(Thousands of barrels)

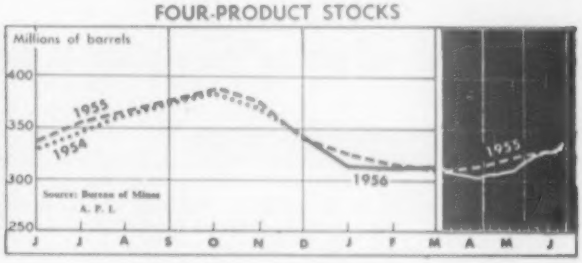
	6-23-56	6-16-56	6-25-55
Pennsylvania Grade	2,607	2,606	2,834
Other Appalachian	2,286	2,255	1,970
Illinois, Indiana, Michigan	11,301	10,760	11,690
Nebraska, North Dakota	2,681	2,634	2,034
Kansas	9,056	9,193	8,262
Oklahoma	26,754	27,294	23,353
Arkansas	3,031	3,098	2,795
Louisiana	15,518	15,570	15,773
North	2,537	2,558	2,733
South	12,981	13,012	13,040
Mississippi	3,094	3,054	2,997
New Mexico	7,432	7,349	8,548
Texas	123,958	124,042	128,293
East Texas proper	9,178	9,172	10,092
West Texas	60,447	60,362	56,660
Texas Gulf	22,402	21,859	26,087
Other Texas	31,931	32,649	35,454
Wyoming	18,735	18,216	15,884
Other Rocky Mountain	6,338	6,169	5,202
California	27,918	27,511	31,090
Foreign	†14,922	14,324	12,680
Total	275,631	274,075	273,405

*Bureau of Mines. †Includes 4,229,000 bbl. in California.

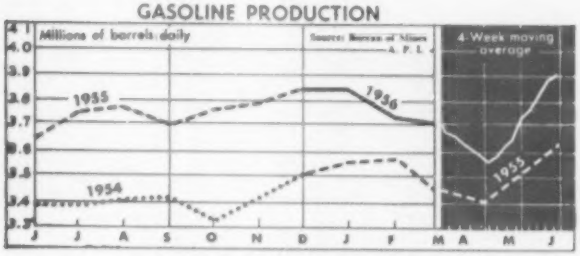
REFINERY RUNS



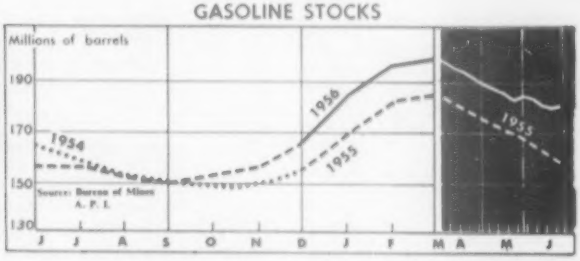
FOUR-PRODUCT STOCKS



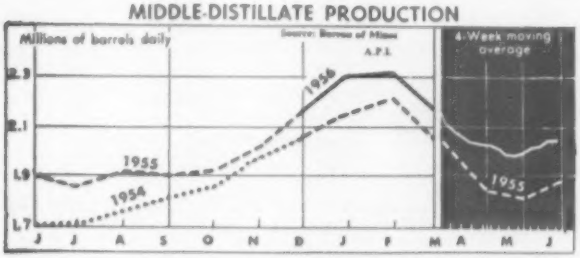
GASOLINE PRODUCTION



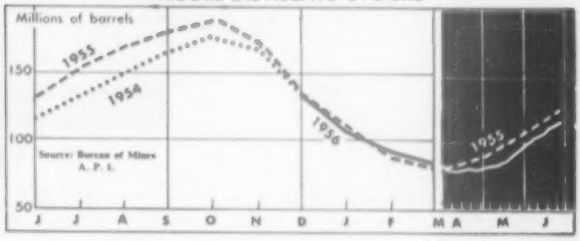
GASOLINE STOCKS



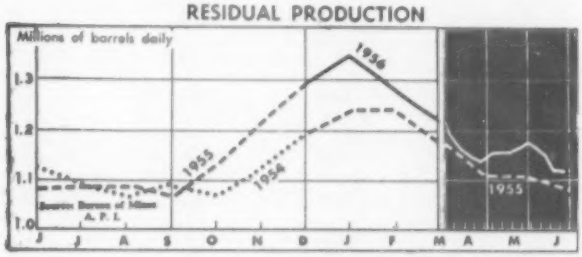
MIDDLE-DISTILLATE PRODUCTION



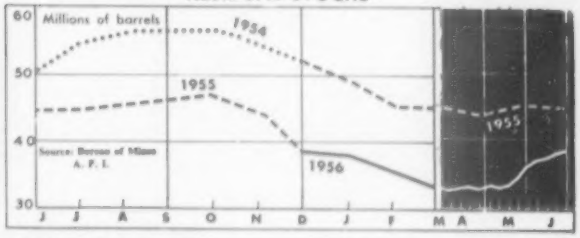
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JUNE 29

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,173	480.6	30.6	314.9	213.4	41,356	10,229	27,983	9,182	1,026	421.9	27.4	253.9	176.7
Appalachian:														
District 1	109	42.7	3.3	31.1	7.0	4,461	459	1,717	340	91	34.3	2.9	20.9	4.6
District 2	107	53.0	7.8	15.4	11.6	2,800	631	756	226	100	50.3	4.0	13.2	10.7
Ind., Ill., Ky.	1,389	710.4	78.1	254.4	156.9	33,155	4,678	13,289	4,365	1,404	748.5	63.0	259.3	165.0
Minn., Wis., Dak.	88	41.6	6.9	23.1	8.0	6,749	734	4,593	292	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	720	411.7	14.3	181.7	28.1	15,997	1,341	9,548	1,245	704	414.4	19.9	153.5	30.3
Inland Texas	280	195.6	4.1	52.1	23.0	6,586	373	1,681	1,396	247	176.4	8.1	47.5	20.4
Texas Gulf Coast	2,011	940.1	89.7	502.9	262.1	24,643	3,788	13,411	5,637	1,811	845.7	91.8	435.1	241.2
La. Gulf Coast	750	383.6	55.3	182.2	52.6	10,530	2,402	6,043	1,745	675	338.6	36.6	188.1	51.4
N. La. and Ark.	89	35.6	6.0	22.0	5.6	4,330	407	1,740	167	95	35.3	6.1	24.2	6.1
Rocky Mountain:														
New Mexico	23	11.7		4.0	2.9	400	5	109	12	23	10.6	0.5	3.7	3.2
Other Rocky Mtn.	289	151.4	3.6	61.3	41.1	6,988	342	2,616	871	268	119.3	3.9	61.4	33.1
California	1,116	468.0	3.9	120.3	325.1	23,606	390	10,186	12,896	1,040	447.8	5.3	167.2	337.0
June 29, 1956	8,144	3,926.0	303.6	1,765.4	1,137.4	181,601	25,779	93,672	38,374	7,484	3,643.1	269.5	1,628.0	1,079.7
June 22, 1956	8,087	3,894.7	279.1	1,783.9	1,099.4	181,104	24,583	87,793	38,050					
July 1, 1955	7,499	3,669.0	289.4	1,608.1	1,107.7	159,611	29,899	99,981	44,799					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Ind., Ill., Ky.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.50-12.00
Premium (96 octane)	13.25-13.75
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.25-11.50
Regular (92 octane)	11.50-12.00
Premium (97 octane)	13.00-13.25
Premium (98 octane)	13.25-13.75
California—Los Angeles (rack):	
Regular (84 octane)	12.9-13.3
Premium (93 octane)	14.9-15.3
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
Distillate No. 2	8.75-9.25
New York Harbor (barges):	
Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65
Caribbean area (cargoes):	
Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.80
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
200 vis. neutral (180 at 100°), 25 p.t.	23

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02	....	....	....	....
15-15.9	2.08	....	....	....	....
16-16.9	2.13	....	....	....	....
17-17.9	2.19	....	....	....	....
18-18.9	2.24	....	....	....	....
19-19.9	2.30	....	....	....	....
20-20.9	2.35	$2.50	....	$2.37	....
21-21.9	2.41	2.52	....	2.39	....
22-22.9	2.47	2.54	....	2.41	....
23-23.9	2.52	2.56	....	2.43	....
24-24.9	2.58	2.58	$2.91	2.45	....
25-25.9	2.64	2.60	2.93	2.47	$2.13
26-26.9	2.69	2.62	2.95	2.49	2.19
27-27.9	2.76	2.64	2.97	2.51	2.24
28-28.9	2.83	2.66	2.99	2.53	2.29
29-29.9	2.91	2.68	3.01	2.55	2.34
30-30.9	2.97	2.70	3.03	2.57	2.39
31-31.9	3.04	2.72	3.05	2.59	2.44
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.52
34-34.9	3.27	2.78	3.11	2.65	2.56
35-35.9	3.34	2.80	3.13	2.67	2.60
36-36.9	3.39	2.82	3.15	2.69	2.64
37-37.9	....	2.84	3.17	2.71	2.66
38-38.9	....	2.86	3.19	2.73	2.68
39-39.9	....	2.88	3.21	2.75	2.70
40 and up	....	2.90	3.23	2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, May 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.45
Middle District	4.32
Southwest Pennsylvania	4.03
West Virginia	3.91
Buckeye Grade	3.85
Zanesville Grade	3.10
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	†2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC+70%)	$4.85
★ Gulf-U.S.N.H., dirty (USMC+60%)	4.56
★ N.W.I.-U.S.N.H., dirty (USMC+45%)	3.92
★ N.W.I.-U.K., dirty (Scale+80%) (58s. 0d.)	8.12
★ P.G.-U.K., clean (Scale+125%) (119s. 10d.)	16.78
★ Sidon-U.S.N.H., dirty (USMC+20%)	9.36

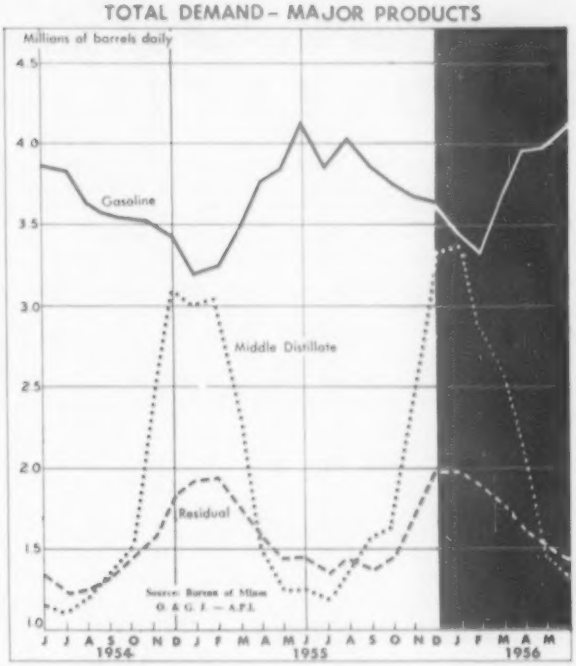
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

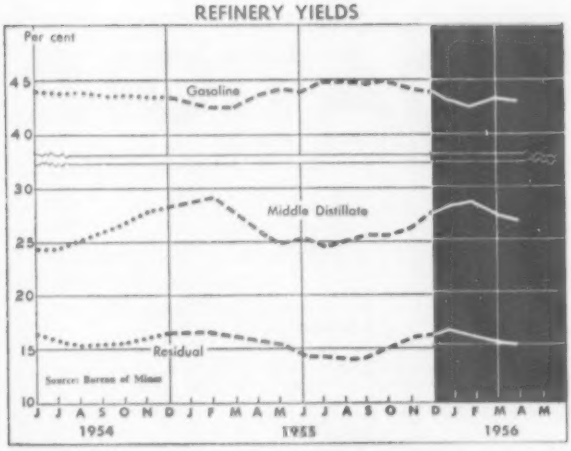
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
June 1956*	4,136	3,902	181,500
May 1956*	3,992	3,712	184,676
April 1956	3,859	3,557	193,299
July 1955	3,847	3,744	157,079
June 1955	4,112	3,643	157,439
KEROSINE			
June 1956*	153	295	25,800
May 1956*	176	293	21,710
April 1956	272	299	18,227
July 1955	192	286	32,749
June 1955	155	269	29,830
DISTILLATE			
June 1956*	1,173	1,751	93,700
May 1956*	1,279	1,704	76,632
April 1956	1,640	1,713	63,571
July 1955	993	1,575	119,169
June 1955	1,081	1,628	100,652
RESIDUAL			
June 1956*	1,436	1,119	38,400
May 1956*	1,511	1,170	35,686
April 1956	1,622	1,130	32,740
July 1955	1,328	1,091	44,894
June 1955	1,457	1,080	44,398

*Preliminary. †Thousands of barrels.

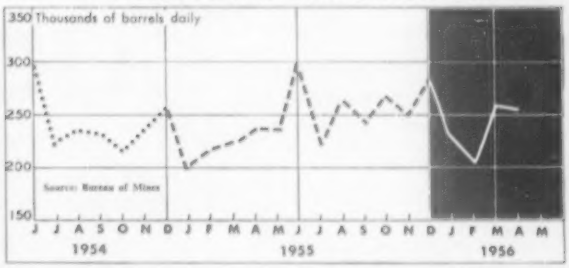
TOTAL DEMAND – MAJOR PRODUCTS



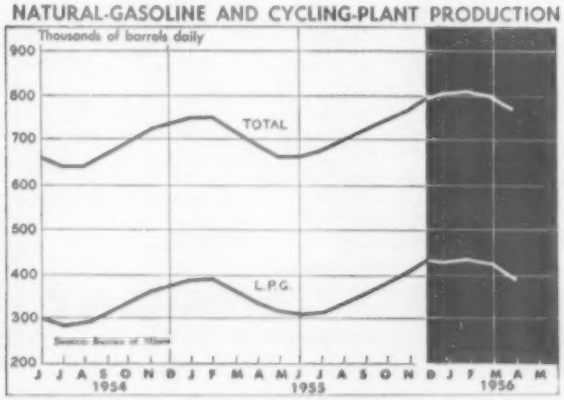
REFINERY YIELDS



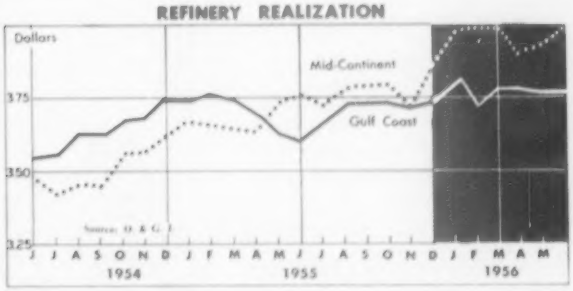
TOTAL DEMAND–AVIATION GASOLINE



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	June* 1956	May* 1956	April 1956	June 1955
Mid-Continent	$3.99	$3.94	$3.80	$3.76
Gulf Coast	3.77	3.77	3.78	3.60

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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U-15 DRILLING RIG located 5 miles North of Laverne, Oklahoma, now operating. 3 NKU Waukesha Motors. Hydraulic Floor Operated Blowout Preventor. 131' Lee C. Moore Mast, steel mud pits. 7⅞ x 16 Gardner-Denver Pump. 8000' 4½" Drill Pipe, recomplete. Call CE 2-6318, Oklahoma City, Oklahoma.

FOR SALE—Near Eureka, Kansas, 4 miles 2" No. 1 single length line pipe, beveled for welding, 25 cents per foot. Contact C. W. Schwenker phone 644, El Dorado, Kansas, or write Cities Service Oil, Patridge, Bartlesville, Oklahoma.

TANKS FOR SALE

Offers entertained for purchase of four 150,000 barrel welded, cone-roof, oil-storage tanks; 150 x 48 feet. Constructed to A.P.I. standard 12-C less than 7 years ago. Available July 1st, 1956.

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TWO MODERN and COMPLETE REFINERIES

All equipment and machinery for sale at fraction of original cost.

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Phone HA 1-1000

Field Office: Cabin Creek (suburb of Charleston, W. Va.)

Phone East Bank 3611. Roy Crisp, Mgr.
P. O. Box 2921, Charleston, W. Va.

FOR SALE EQUIPMENT

FAILING 1500 H.D. drill with 4½ x 5 pump, automatic pulldown, mounted on 1951 Ford. Also Griffin water tank, mounted on 1951 Ford. Write P. O. Box 819, Longmont, Colo., Phone 1333.

FOR SALE: Wilson-Snyder mud pump, 7¼" x 18" Top condition and less than half price. L. T. Peyton Machine Shop, Vernal, Utah. Phone 267.

CASING COUPLINGS for sale, 13⅜" OD x 8 Rd. x 8" Long. New, bright, prime. Never in use. Box J-592, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE EQUIPMENT

3000, 12¾" —8 thread collars with Dutchman. 5000 —8" —8 thread collars with Dutchman.

REDNEB PIPE CO.
SHREVEPORT, LA.
P. O. BOX 1798

FOR SALE EQUIPMENT

96 FT. IDECO MAST on lowbed trailer, with or without Hopper hoist. 1705 Burton Way, Bakersfield, Calif.

NEED A PIPE LINE

Have 800 Miles 8" Line Pipe we are taking up through Illinois, Indiana, and Ohio. Will furnish pipe, go in on a deal, or finance.

We are open for any kind of deal.

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COMPLETE POLY UNIT, BUILT 1950
UOP RATED 144 BBL./DAY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
5—Adm. Heat Exchangers, 644, 424, 346, 176 sq. ft.
1—5' x 96' tower, 40 tray, 135# WP.
1—7' x 30' Propane tank, 250# WP.
1—6' x 34' Vacuum tower, 150#.
1—2' x 50' tower, 24 trays.
5—Welded tanks, 10' x 40', 10' x 30', 5' x 20'.
7—Oilfield boilers, 100 hp., 275#
1—Ethyl lead plant.
2—Convection furnaces, 20 MIL BTU/hr
1—Vapor phase cracking furnace.
12—Welded storage tanks, 5000, 2000, 1,000, bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
30—Duplex piston pumps, all sizes.
1—10' x 30' asphalt still.
6—Steel Bldgs., 20 x 150, 20 x 20, 20 x 40,
1—BS&B Oil and gas separator, 10.7 mcf, 3500 BBl./day.
Large Selection of Series 15, 30 Steel Valves, 1" to 8".
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

TOWERS & VESSELS

8' x 75' 25 tray 40#
2' x 60' 35 tray 560#
5'6" x 59' 30 tray 200#
2' x 45' 30 tray 250#
13" x 35' 30 tray 500#
2—6½' x 25' hor tanks 50# WP.

COMPRESSORS

2 Worth LTC-6 800 hp.
1 Worth LTC-3 400 hp.
1 IR XVG-8 300 hp.
3 Penn Comps 43 CFM 500 lbs. 276 CFM 160 lbs., 230 CFM 150 lbs.

MISCELLANEOUS

6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
800 ft. of 2" 4-6 ch pipe
Large quantity of 410 SS chrome strips and sheets.
Tremendous selection stainless steel and steel valves ½"-6".
BJ hot oil pump 3 x 9, 13 st, 325 gpm, 4000' hd.
Gould 16" pump 10,500 gpm, 135' hd.

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FOR SALE EQUIPMENT

SEAMLESS CASING

22,500 feet 7" OD Seamless, 23#, Grade N-80, 8 rd thd. LT&C, located in Tulsa, priced for quick sale. Degen Pipe and Supply Company, Tulsa, Oklahoma.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

GAS COMPRESSORS—3 Bessemer type 10 twins direct connected units—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

FOR SALE—At our Tallant chemical plant which we are dismantling 20—10' x 18' vertical steel tanks, $500.00 each suitable for salt water, oil, and other liquids; also a quantity of various sizes vertical and horizontal tanks. See T. P. Mace at the plant, or write H. D. Patridge, Cities Service Oil, Bartlesville, Oklahoma.

FOR SALE: National 50 Drilling Rig Complete, for details, call or write Ralph W. Shebester, Box 337 Pauls Valley, Oklahoma. Telephone 570.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE
BY ESTATE

5,000' rig, Wilson Giant drawworks with 6NK-18A Waukesha; 212 P Oilwell mud pump, with NKU Waukesha; 5,000' of 4½" Natl Smls Internal upset 16.6# drill pipe, with Hughes API full hole seal grip tool joints, 122' standard derrick, rig complete.

2,000' truck mounted rig. Wilson super winch with 6MZ Waukesha; 5 x 10 Oilwell mud pump with 145 h.p. Climax engine; 3,000' of 3½" 13.30# drill pipe; 50' telescoping mast, rig complete.

Phone 4-5942 or Write
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FOR SALE EQUIPMENT

2 GMC MODEL #12103 Twin Six Diesel Engines, excellent condition—one with 11,000 series torque converter. See at Carter Engine and Equipment Co. or call Dixon Drilling Company, 4-8503, Abilene, Texas.

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TYPE E1 GUIBERSON rotating pack-off head w/rubbers and casing adapter. Used for air drilling. A-1 condition. $700.00. Contact R. F. Mesker, GI 7-9483, Tulsa, Oklahoma.

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COMPRESSOR BUILDING — Structural steel, 12' x 35' x 120. Boswell-Frates Company 1003 Kennedy Building, Tulsa, Oklahoma.

5½ KEYSTONE SPUDDER. Three strings of tools. New power unit. Forged, fishing tools. Two Trucks. Water-Tank Trailer. Lots Extras. $3,500. McLaughlin, 3506 W. Pikes Peak, Colorado Springs, Colo.

GASOLINE PLANT EQUIPMENT
FOR SALE

1—800# 20 MMCF Absorber with Scrubber, etc.
1—6 Cyl. Buda Engine, 243 H.P. at 900 RPM with Starting Engine.
1—Fluor "Counterflo" induced Draft Cooling Tower Complete.
2—20 MMCF LTX Units.
Vessels, Generators, Pumps, Instruments, Pipe, Valves, and Fittings and Other Equipment necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

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EQUIPMENT WANTED

USED COMPRESSOR wanted for natural gas. Packaged unit. Maximum discharge pressure 200# with compressor cylinder 11" x 13" or equivalent. Notify E. R. Sink, operator, Route 3, Carthage, Texas.

INTERESTED in Trailer mounted unitized Failing 2500, Cardwell A.H., Joy 350 or similar rig for drilling with 3½ D.P. to 2500 feet. Must not be over 3 years old and good condition. Send photo, Serial No., asking price, location of rig, and when available for delivery. Also must handle doubles range 2 D.P. Dick Allen, WELL SERVICE, INC. 19th Floor Kanawha Valley Bldg. Charleston 1, West Virginia.

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Unusual opportunity for professional growth and development for man as Chief Chemist in a large natural gasoline and sulphur recovery plant located in Tioga, North Dakota.

Work involved is not restricted by laboratory detail as operating and management duties are required.

Please include resume of experience and personal history in sufficient detail to justify personal interview to be arranged at your convenience.

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Openings also exist for BBA and Liberal Arts majors as sales trainees.

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6000 FT. CAPACITY WELL SERVICING UNIT
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Model E-563-42 Fred E. Cooper - Allis-Chalmers Single Drum Servicing Unit with Two-Pole, 65 Ft. High Telescoping Mast powered by Model AM-1153-54 Allis-Chalmers Engine; Mounted on L-192 International Truck, 1953 Model.

Excellent condition. Unit new 1950. Truck new 1953, only 3000 road miles. Rig includes blocks, rod and tubing equipment and hand tools.

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Graduate engineers with minimum 5 years' experience in design or inspection of petroleum processing plants and equipment. Major part of experience must have been in inspection work entailing general knowledge of all facilities. Develop inspection methods, supervise and conduct inspections and advise operations on codes and equipment limitations in a major oil installation located in Saudi Arabia.

Write giving full particulars regarding personal history and work experience. Please include your telephone number.

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United Geophysical Corporation

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HELP WANTED

VALUATION ENGINEER

Oil Company seeking to purchase producing oil properties desires services of petroleum engineer with experience in reservoir valuation and appraisal work. In addition to practical technical knowledge and experience, must have ability to make and develop contacts. Some experience in the ABC economics of financing purchases also desirable. This is a permanent salaried position with excellent opportunities for growth. Written reply should furnish details on education, experience, age, personal and professional references, and some idea of salary requirements. Small recent photo would be helpful.

Box J-528, The Oil and Gas Journal,
Tulsa, Oklahoma.

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HELP WANTED

ENGINEER

. . . For pipeline and pump station design. Engineering degree required.

Age 25 to 30 preferred. Permanent position with aggressive engineering company in Tulsa. Unlimited opportunity for smart, conscientious man with initiative. Send complete background and salary expected. All replies strictly confidential. Write

BOX J-618,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PETROLEUM ENGINEERS

Graduate Petroleum Engineers with 2 - 6 years' experience wanted by Major Oil Company for work in Mid-Continent and Gulf Coast areas. Openings available for Reservoir and Field Production Engineers. In first reply give resume of experience, date available, and salary expected.

BOX J-479, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

CHEMICAL ENGINEER

West Coast Independent Oil Company (San Joaquin Valley). Requires refining experience in process design and operations. Must have engineering degree. Salary commensurate with ability and experience. Reply outlining personal history, photo and work experience.

Box J-611,
The Oil and Gas Journal,
Tulsa, Oklahoma.

PETROLEUM ENGINEERS

(AGES 25 - 38)

Career opportunities for petroleum engineers with a major U. S. integrated oil company operating in South America. Position vacancies exist for reservoir and petroleum production engineers at levels requiring from five to eight years of pertinent experience. Candidates must have a degree in petroleum, mechanical or chemical engineering. Excellent growth opportunities in an expanding organization. Salary, including bonus, $12,600 - $17,000, depending on qualifications and experience. Liberal employee benefits and home vacations with travel expenses. Send complete resume of education, personal data and work experience. Interviews will be arranged for qualified candidates. All replies confidential.

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New York 19, N. Y.

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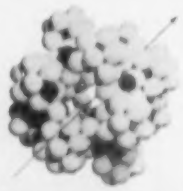

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UNION CARBIDE AND CARBON CORPORATION
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For responsible staff positions in New York Office directing the work of groups of experienced engineers doing process evaluation and design, economic studies and related work on refining and crude oil handling facilities together with supporting power plants and other utilities. Work entails occasional trips of short duration to Europe and Middle East. Chemical Engineering degree plus 5 years' process experience, preferably in petroleum.

Salary commensurate with training and work experience. Liberal benefit program. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 100

ARABIAN AMERICAN OIL COMPANY

505 Park Ave., New York 22, N. Y.

HELP WANTED

WANTED: PARTY CHIEF for aggressive contract company. Man with degree in geology or engineering and presently in position of Assistant Party Chief preferred. Box J-600, The Oil and Gas Journal, Tulsa, Oklahoma.

DRAFTSMAN

. . . For pipeline and pump station design. Age 25 to 30 preferred. Permanent position with aggressive engineering company in Tulsa. Send complete background and salary expected. All replies strictly confidential. Write

Box J-619, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

Major Oil Company has openings in Production Dept. in Venezuela for a number of graduate petroleum engineers.

OPENINGS also for petroleum, mechanical & chemical engineers for work in drilling, pipeline & gas depts. Salary commensurate with experience.

Please send details of Experience to:

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Natural Gas Transmission Company in Rocky Mountain area needs Gas Engineer. Relocation expenses paid. Permanent employment with liberal employee benefits. Salary commensurate with training and experience. Position in Gas Supply Department.

Degree in Natural Gas or Petroleum Engineering required. Two or three years field experience preferred.

Submit details of qualifications, salary requirements and experience to

Box J-613,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

OIL INDUSTRY Employment Service, 405 Tuloma Bldg., Tulsa, Okla. For technical, experienced oil men, under 40.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

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PIPELINER-PRODUCTION MAN, 43, family man desires job with Pipe Line Co. or Independent Operator. 13 yrs. with major P.L. Co., 5 yrs. in production and superintendent in construction and operation of gathering systems. 23 yrs. practical experience. Would prefer work in Colorado or Rocky Mt. area. Box J-578 The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGIST. 8 years diversified Major Co. experience. Rocky Mountains and South America. Desires position with active independent. Box J-612, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER
with extensive foreign and United States experience as production superintendent and chief petroleum engineer. Outstanding record of accomplishment and personnel management. Desires responsible position with future, domestic or South America. Age 39. Box J-610, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGIST: 13 years major company experience on Gulf Coast. Desires change. Box J-617, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE, legal background. 23 years Land, Geological and Management experience in Mid-Continent and Rockies. Desires connection with aggressive company or group. Box J-609, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT CONNECTION with aggressive independent. Have 18 years experience Land, Production, Drilling. Now Rocky Mountains but will relocate. Box J-615, The Oil and Gas Journal, Tulsa, Oklahoma.

ACCOUNTANT—General and cost for Texas or Mexico. Heavy industrial experience in supervisory capacity. Oil production. Standard cost and systems installation. Box J-616, The Oil and Gas Journal, Tulsa, Oklahoma.

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FOR SALE: Producing oil and gas wells and leases located in Garvin, Stephens, Kiowa Counties, Oklahoma. For details call or write, Ralph W. Shebester, Box 337, Pauls Valley, Oklahoma. Telephone 570.

80 ACRES AND WELL drilled or 160 acres and two wells drilled through sand. Offset to high gravity oil well lost recently trying to produce 2 sands. 21 producing wells. 4 dry in Section north. New wells drilling. ½—$550.00; ½—$2000.00 each well. L. Price, Coweta, Okla.

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Box J-605,
The Oil and Gas Journal,
Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

WANTED: Responsible party to share development of 140 Acre Oil-Gas lease, and to finish started well; marketing facilities available in Southern Pa., Northern Md. Section; Will cooperate in any way possible. Write: Oscar Lohman, c/o Tonoloway Petroleum Corporation, Box 280—Rt. #1, Clearspring, Md.

WILL ASSIGN undivided half interest 40 acres for well drilled and equipped offsetting 25 bbls. per hour natural. Five other pay sands. Phone RI 2-4533, Tulsa.

CAPITAL CONTACT. Will consider placing proposition requiring corporate financing on Underwriting basis. Confidential. Write Consultant, 817 51st St., Brooklyn, N. Y.

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WANTED CAPITAL: To drill Oriskany sand well to 6900 ft. in newly discovered Penn Gas Field. This lease is high on structure. Located between 2 discovery wells. Cost $80,000. I have ⅝ of drill costs. Will sell ⅜ at $10,000 each or $2,500 per ½nd. Production almost a certainty, pays 27½c per thousand. Must drill in next 30 days. No allowables. Box 22, Emmaus, Pa.

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$40,000,000 TO INVEST in oil production, any part over $1,000,000, give full report. TJADEN, Eagle Lake Texas.

EQUIPMENT MEN . . . in the News

Ready Manages New Service Area for Johnston Testers

MAX READY

Johnston Testers, Inc., Houston, has announced the creation of a new service area for the Louisiana Gulf Coast. This territory was formerly in the Arkansas-Louisiana - Mississippi area. Max Ready has been appointed area manager. He came to Johnston Testers in 1949 from Ray & Wolff Drilling Co. He became district manager at Shreveport, transferring to Lafayette in 1953 as sales representative in the Louisiana Gulf Coast. He will make his headquarters in the area office at Lafayette.

Alco Appoints Gupton Houston District Manager

Appointment of Theodore Gupton as district manager at Houston has been announced by Alco Products, Inc. He had been manager of the company's Kansas City district since 1934.

Gupton's experience includes service with Prairie Pipe Line Co. and McIntosh & Seymour Corp., an Alco predecessor company. Gupton was named district sales manager at Tulsa in 1931 and manager at Kansas City in 1934.

Dempster Heads Republic Flow Meters Canada, Ltd.

Republic Flow Meters Co., manufacturer of combustion controls and industrial instruments, has announced the appointment of James H. Dempster as general manager of Republic Flow Meters Canada Ltd., with head office and plant in Toronto.

Dempster has previously managed research, plant-development engineering, and process division for a leading Canadian company.

Rockwell Promotes Bowman, Northcutt, and Walters

G. T. BOWMAN

Gilbert T. Bowman, general products manager, and J. W. Northcutt, southern regional sales manager, have been named assistant vice presidents of the Meter & Valve Division of Rockwell Manufacturing Co. Both will make their headquarters in Pittsburgh, Pa.

Jack H. Walters, product manager, petroleum and industrial liquid meters, will move to Rockwell's southern

NORTHCUTT

J. H. WALTERS

regional headquarters in Atlanta, Ga., to succeed Northcutt. These promotions were announced by Lloyd A. Dixon, Jr., vice president in charge of the division.

Bowman, who joined Rockwell in 1940, became San Francisco district sales manager in 1945, sales manager, gas products and Nordstrom valves in 1952, general-products manager in 1954. Northcutt, who joined Rockwell in 1937, has been southern regional sales manager since 1952.

Walters joined Rockwell in 1945 as a sales engineer in the Louisiana territory. He became Houston district sales manager in 1951, moved to Pittsburgh

as product manager of gas products in 1954, and became product manager, petroleum and industrial meters, in 1955.

Continental Opens New Store at Kimball, Neb.

Above is the new Continental Supply Co. store at Kimball. R. R. Hall is the manager of the store. This gives Continental 11 stores and offices in its Rocky Mountain division to include Cut Bank, Glendive, and Billings, Mont.; Cody and Newcastle, Wyo.; Denver, Artesia and Sterling, Colo.; and Williston, N. D. Headquarters for the Rocky Mountain division is Casper, Wyo., and G. R. Pike is the division manager.

Royston Appoints Curley As Sales Engineer

William R. Curley has been appointed sales engineer for Royston Laboratories, Inc., Blawnox, Pa. He will represent Royston in Louisiana, Mississippi, Arkansas, Missouri, and West Tennessee from headquarters at Monroe, La.

Curley has served as an engineer in the design, construction, and operation of all phases of the natural-gas industry, having worked in production, transmission, distribution, compressor station, gasoline and hydrocarbon and corrosion engineering departments.

Pepco Is Kimray's North Texas Distributor

Kimray, Inc., Oklahoma City, manufacturer of oil and gas equipment and controls, has announced the appointment of Production Equipment Products Co. as its North Texas distributor. Pepco, maintaining offices and warehouse stock in Wichita Falls, Tex., is headed by Art I. Robinson.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 320 acres of land in two parcels within the known geologic structure of the Hugoton field, Kansas, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before 2:00 P.M., MST, August 7 1956, when bids will be opened. Details of the lease offering, and how and where to submit bids may be obtained from the Land Office, Cheyenne, Wyoming. Perry T. Williams, Manager.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 798.72 acres of land in four parcels within the known geologic structure of the Big Muddy Field, Wyoming, and approximately 440.15 acres of land within the known geologic structure of the Lance Creek field, Wyoming, in six parcels, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before 2:00 P.M., MST, August 15, 1956, when bids will be opened. Details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Perry T. Williams, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Salt Lake City, Utah. Notice is hereby given that approximately 80 acres in two parcels: Parcel #1: SE¼ NE¼ Sec. 14, T. 41 S., R. 12 W., S.L.M., Utah, containing 40 acres; Parcel #2: NW¼ NE¼ Sec. 23, T. 41 S., R. 12 W., S.L.M., Utah, containing 40 acres, within the known geological structure of the Virgin Oil Field, Utah, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 p.m. M.S.T. August 7, 1956, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the bureau's Salt Lake City, Utah, Land Office. Ernest E. House, Manager, Land Office, Salt Lake City, Utah.

LEGAL

SEALED BIDS will be received until 2:00 P.M., Mountain Standard Time, July 17, 1956 and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah for the leasing of 466.29 acres more or less, of Allotted Indian lands in two separate parcels located in Sections 12, 14 and 15, Township 6 South, Range 22 East, Salt Lake Meridian, Uintah County, Utah, for oil and gas mining purposes. The details of the lease offering and filing of bids may be obtained by addressing an inquiry to Mr. John O. Crow, Superintendent, Uintah and Ouray Agency, Fort Duchesne, Utah or to the Regional Oil and Gas Supervisor, U. S. Geological Survey, Casper, Wyoming.

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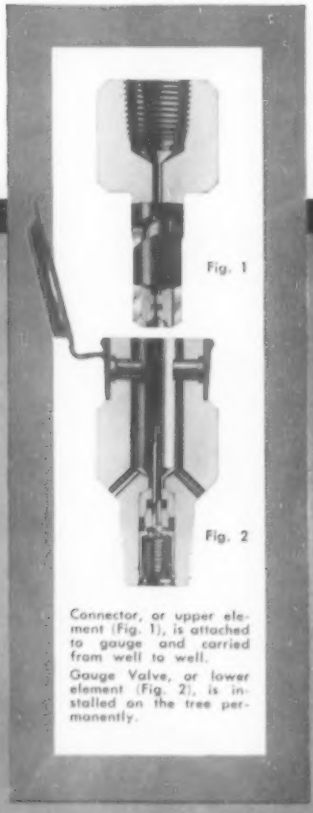

Connector, or upper element (Fig. 1), is attached to gauge and carried from well to well.

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